June 1961

Electrical South

a W.R.C. Smith Publication

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This electrical ... ted drafting room helps promote sales of luminous ceilings

In this issue:

Giant housing project demands mass-production wiring

Loading practice for distribution transformers

Utility engineering section begins on page 57

Unretouched photograph

This cut-away view illustrates how the improved "SOLID-FIL" development completely encapsulates internal ballast components leaving no voids . . . forming integrated *UNITIZED CONSTRUCTION*.

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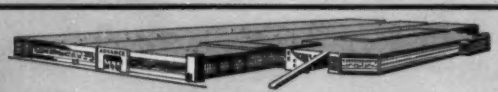

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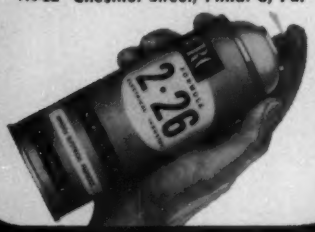

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FRONT COVER—Next month's issue will present details on this drafting room, located in the headquarters of Sachs Electric, St. Louis, Mo. The room shows how contractors can use their facilities to emphasize and dramatize the ideas and equipment they are selling.

Contents

Big project demands mass-production wiring..... 36
Profits influenced by headquarter facilities..... 40
Flexibility designed into tall building..... 42
Timesavers speed shopping center job..... 44
By David C. Smith, B and D Electric Co.
IES conference stresses school lighting..... 46

Utility engineering

Utility engineering section..... 57
Loading of distribution transformers..... 66
By C. C. Wolf, The Potomac Edison Co.
New capacitor control senses current and voltage..... 70
By R. C. Odell, Allis Chalmers Manufacturing Co.
Southern plant to use aluminum towers..... 72
Characteristics of substation loads..... 74
By Clark Denison, Oklahoma Gas and Electric Co.
Utilities buy mobile equipment..... 80
Homes have inadequate service entrances..... 82
By Clarence B. Grund, Jr., Southern Services, Inc.
Meeting covers all facets of poles..... 90

In every issue

Economic comment..... 4
By Dr. J. Whitney Bunting
Washington report..... 6
By Jack James
Catalogs and bulletins..... 14
Postage-paid inquiry card..... 19
Contractors tell how..... 48
Understanding the Code..... 50
By Walter R. Stone
New electric utility products..... 96
Helpful literature from manufacturers..... 101, 114
Know the law..... (*)
By Arthur L. H. Street
Estimating data sheets..... 102
News of the industry..... 104
Dates ahead..... 106
News about people..... 108
Technical books..... 110
New electrical products..... 111

*Omitted this month

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

Common stock investment

Professional investors continue to remain loyal to the acquisition of common stocks in contrast to bonds, preferreds, and other forms of investment.

In light of today's current stock market condition, this attitude shows a continued confidence in the general upward trend of stock prices and steady corporate dividends. Recent weeks have seen some slight turndowns in the prices of specific issues, but this has been a spotty trend rather than an over-all decline.

Since professional investors, those who manage large sums of money for foundations and other institutions, create a definite influence on the pattern of the market, their attitudes can be considered to be bellwethers of stock market trends.

Their confident appraisal of present and future market strength is certainly a good omen for the individual investor who does not have the same extensive sources of information.

There is no doubt but that investment in common stock entails some risk over and above other forms of investment opportunity. Since the chance for participation in the success of a business is found principally through the ownership of common stock, so also must be the chance of loss; either from failure to receive dividends or from a decline in the market price of the security owned.

No one should enter the stock investment field without a clear understanding of this cardinal fact. The appraisal of the professional investor on the trends of security price movements is of great value in determining the possible future of stock investments in general rather than for specific issues.

Moreover, in the light of the above, no one should plan an investment program in common stocks without a firm recognition of the possibility of suffering some financial loss as well as gain.

The small investor, or the person who enters the field without proper knowledge or advice, is apt to be badly frightened by some of the trends that may occur. This often causes a prompt withdrawal from the market without any possible hope of recovering such losses either through retention of the stock or switching to a better prospect investment.

Ethics of speculation

Many responsible persons fear the growth of unwise speculation that appears to be evident today. Dr. Keith Funston of the New York Stock Exchange has embarked on a strenuous publicity program designed to keep the uninformed type of investment speculator from entering the market with the hope of making a quick and heavy return.

The Securities and Exchange Commission has also taken a dim view of the trend of speculation in security purchases. Many of the more responsible dealers have sounded words of warning concerning the unhealthy price movements that are created by purchases for quick profit and then prompt selling.

Investors should be aware of these warnings, particularly investors with inadequate understanding of business trends and corporate conditions.

Unfortunately there are individuals in the investment field who do not discourage speculation strongly enough. Their basic interest is often business volume and the consequent commissions they receive for the services they render. In such cases, they fail to live up to the greatest of their service requirements, namely, that they serve not only as a market place for securities but that they provide a valuable consultative responsibility to the investor.

This is often difficult to do, especially when the investor feels that he has "inside information" or special skills in the selection of the right stock for rapid price advance.

But this does not excuse the broker or dealer from his basic, moral responsibility to give the best advice available and to sound proper warnings if the investment program appears to be dangerous or if unwise speculation may be behind the investor's actions.

A wise investment program for an individual should be tailored to his personal needs. Everyone has somewhat different requirements, and it is to his own best interests to review the reasons why he is planning to buy securities before the actual investing takes place. The basic features that must be considered are safety, growth of principal, or added income for specific purposes.

Around these three factors are a variety of other lesser situations that emphasize the need to stress one or more of the basic three. As a person buys insurance after a rather complete evaluation of present position, future needs, and potential hazards, so should the investment program be established.

And one of the most vital considerations is the quality of professional advice sought and received.

Strangely enough, the person who would never think of taking an action without professional advice in most living experiences will frequently purchase securities on a guesswork basis or because of "tips" received from non-professional sources.

The opportunity for loss, in such instances, is extremely grave, but the real hazard is the lack of a programmed attack on the individual's financial needs in the years to come. Certainly, proper action in financial affairs is an essential ingredient in a healthy, happy, and secure future.

Investment counselors and advisers often claim that one of their most important and time-consuming experiences is the unsnarling of programs of investment designed by individuals who have pieced together small packages without consideration of the factors outlined above.

This process is costly to the in-

(Continued on page 122)

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

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Washington report

By Jack James

Digest of Washington news of special significance to the electrical industry

Economy climbs faster than had been expected

SINCE DECEMBER economists have been predicting that this country was pulling out of the recession.

Suddenly last month they began saying that the economy was moving ahead faster than they expected. One reason was the jump of 2½ per cent in April of the industrial production index put out by the Federal Reserve Board. Auto assemblies climbed 30 per cent, steel advanced 15 per cent.

Arthur F. Burns, chairman of the Council of Economic Advisers under President Eisenhower, was one economist, however, who was not surprised by the spurt.

"Historically, recoveries have been rapid, rather than the reverse," he told a newspaper columnist. "I don't see any reason to think this recovery will be slow and halting. I am not aware of any significant depressive influences and I am aware of expansionary influences."

President Kennedy wants to encourage investment

PRESIDENT KENNEDY asked Congress to give businessmen a novel tax credit to encourage them to invest more.

Under the plan businessmen could reduce taxes as much as 30 per cent.

The President proposed that Congressmen allow deduction from taxes of six per cent of investment between 50 and 100 per cent of current depreciation and 15 per cent of investment above 100 per cent of depreciation. In addition, in the year that these tax credits were taken, businessmen could take depreciation on investments.

For example, if Zoom Electric Contractors, Inc., this year depreciates $1,000 in plant and equipment and invests $3,000, the company could subtract from taxes six per cent of $500, or $30, and 15 per cent of $2,000, or $300. The total credit toward taxes would be $330. The company could also depreciate its new investment this year.

The Treasury would lose $1.7 billion taxes under this plan. To recoup, the President proposed 20 per cent withholding of corporation dividends and bank interest to prevent widespread cheating by people who do not report this income; taxes on foreign earnings comparable to those on domestic earnings; an end to the $50 and four per cent income tax exemptions on corporation dividends; and curbing of expense account deductions.

Decision ends NLRB hiring hall regulations

THE U. S. SUPREME COURT said that the National Labor Relations Board has no right to regulate union-run hiring halls.

The Court also said that the Board cannot order a union to reimburse union dues and fees to members merely because of an illegal closed shop.

These decisions were handed down in two cases. In two other cases the Court said that union contracts can require that union foremen do all the hiring and that contracts can incorporate a union's "general laws" with the proviso that those in conflict with state and Federal laws are excluded.

Since 1958, Board regulations have governed most of the hiring halls in the construction industry, including those run by the IBEW. Since that year, too, the Board has applied stiff dues reimbursement penalties to IBEW locals and locals of other unions found to run closed shops.

The Board has required that union-run hiring halls (1) not discriminate on the basis of union membership, (2) let employers refuse to hire any person referred by the hall, and (3) post hiring hall rules conspicuously in the hall.

The Supreme Court said that only hiring halls that discriminate on the basis of union membership are illegal and that hiring halls do not have to meet Board regulations.

New construction rises, housing still lags behind

NEW CONSTRUCTION in April was worth $4.3 billion.

This was ten per cent above March and three per cent above April 1960. Construction in all major categories but housing was running ahead of 1960.

But the $1.6 billion in new housing, although 15 per cent higher than in March, was five per cent below April 1960.

Contractors may benefit from missile base inquiry

THE MISSILE BASE hearings ended last month and Senator McClellan announced a temporary suspension that may become permanent.

But benefits to electrical contractors may last for years. Union featherbedding, union strikes allegedly aimed at forcing high overtime pay, and the stupendous wages paid electricians and other craftsmen were exposed to public view.

Asked why the Army Corps of Engineers had not stopped these practices, an officer replied that politically unions were sacred cows. Congressmen would have castigated the Pentagon if it had intervened into contractor-union relationships.

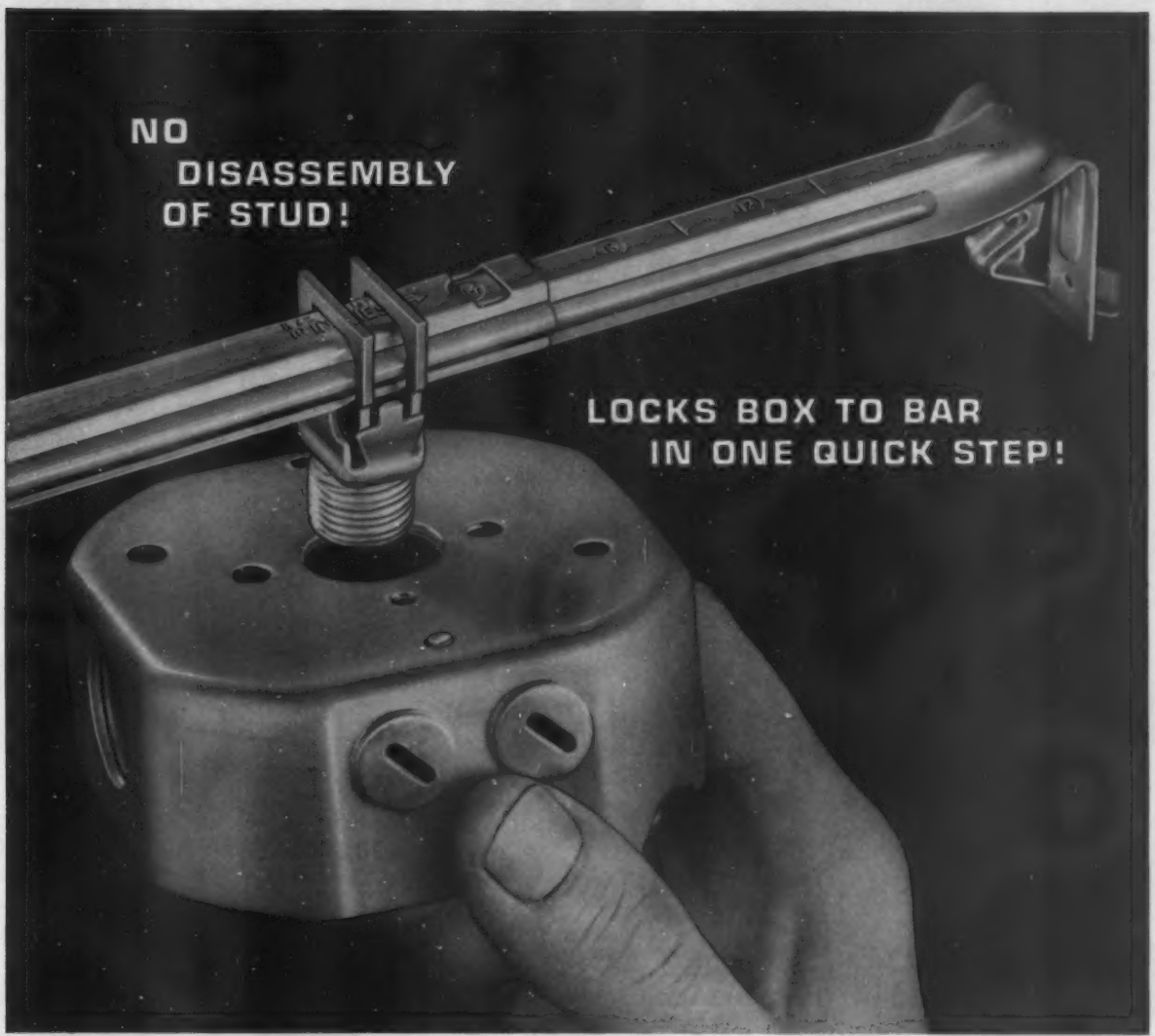
Testimony by an electrical contractor and other contractors revealed how powerless the contractors were to stop these practices.

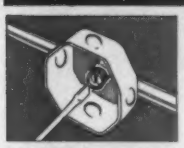
The delay of the space program and the hindering of the ICBM base construction, however, have cost the unions much of the support they had in Congress. It will now be politically feasible for the Pentagon to support the efforts of contractors to stop featherbedding, wildcat walkouts, and vast overtime pay.

On other government contracts, this same situation will also prevail. On government buildings, roads, bridges, and housing, electrical contractors who ask for a good day's work for a good day's pay from union journeymen can expect more support from the government.

(Continued on page 121)

NEW EFCOR BAR HANGERS





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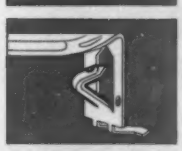

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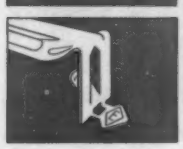

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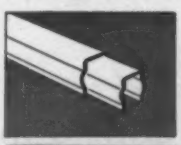

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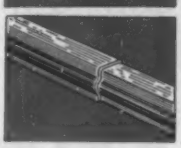

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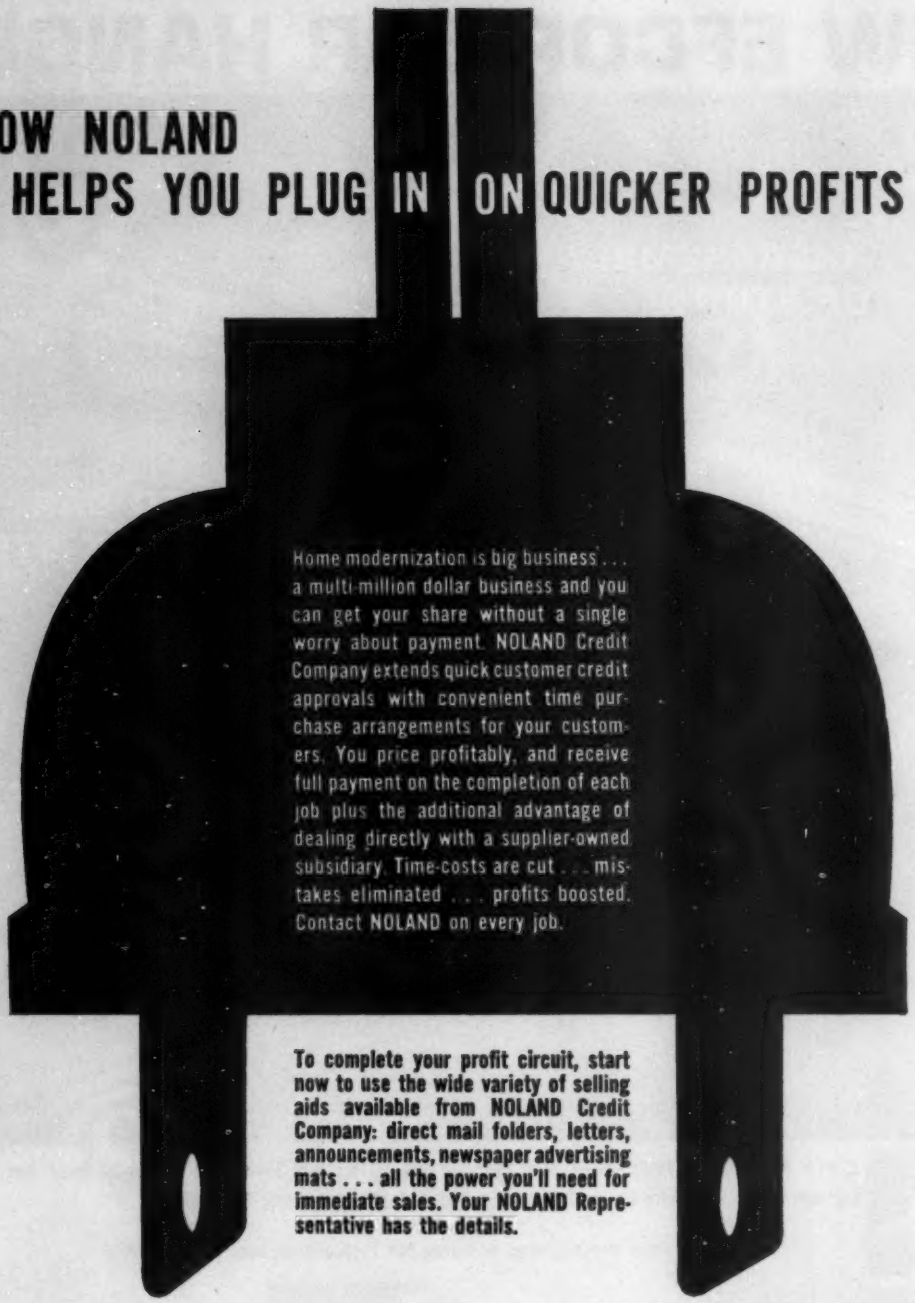

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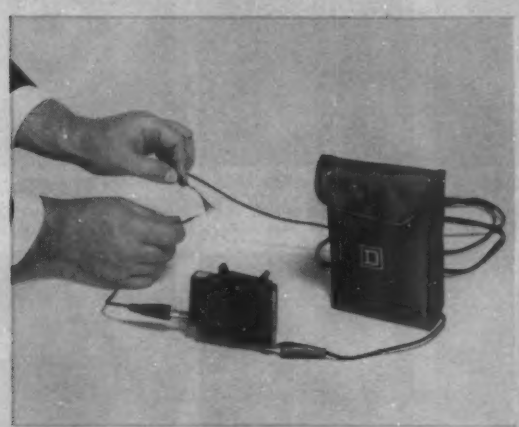

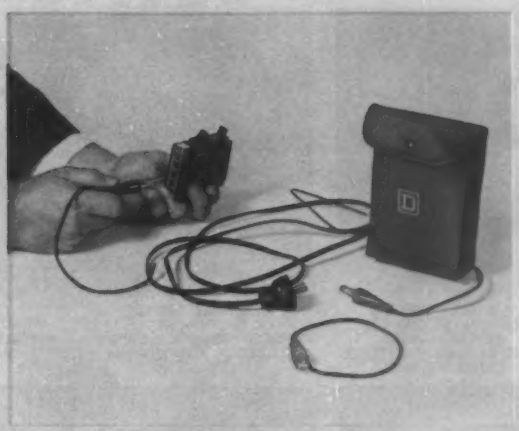

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AT LEFT • **The frayed cord test shows how QO breakers give positive protection against "*flash*" shorts. Conventional overcurrent protectors provide overload and short circuit protection for branch wiring, but don't open fast enough to protect smaller extensions from such shorts.**

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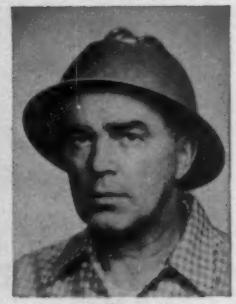

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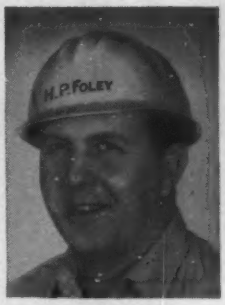
J. J. LIVINGSTON CO.
MISSILE FACILITIES
BANGOR, MAINE



ROBERT F. BROWN
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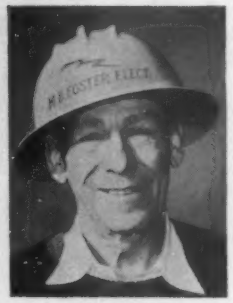
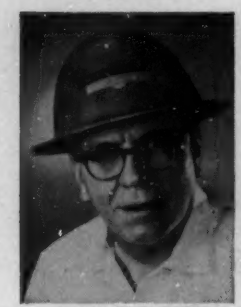


JOE DeGOURSEY
M. B. FOSTER
HARBOR STATION PWR. PLT.
BRIDGEPORT. CONNECTICUT



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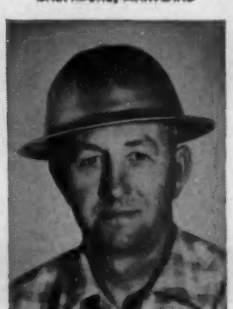

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UNITED TECH. RESEARCH CENTER
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SANBORNE-WATSON FLAGG
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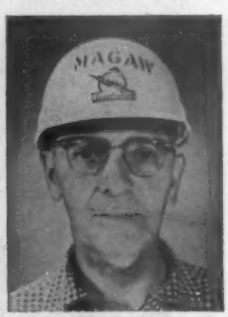
INDIANAPOLIS, INDIANA



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Field Men say...

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For over 40 years top Field Superintendents, Engineers, and Project Managers of the nation's leading electrical contracting firms have specified O.Z. electrical fittings.

Their experience and background has taught them to rely on O.Z.'s complete product line and superior quality. They know O.Z.'s broad distributor program means they get the right fittings—at the right time—at the right place.

On your next job—big or small—take a tip from the top. Get the best quality and widest choice at competitive prices. Specify O.Z. fittings all the way and you too will say, **"They're OK if they're O.Z."**

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- CAST BOXES
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- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

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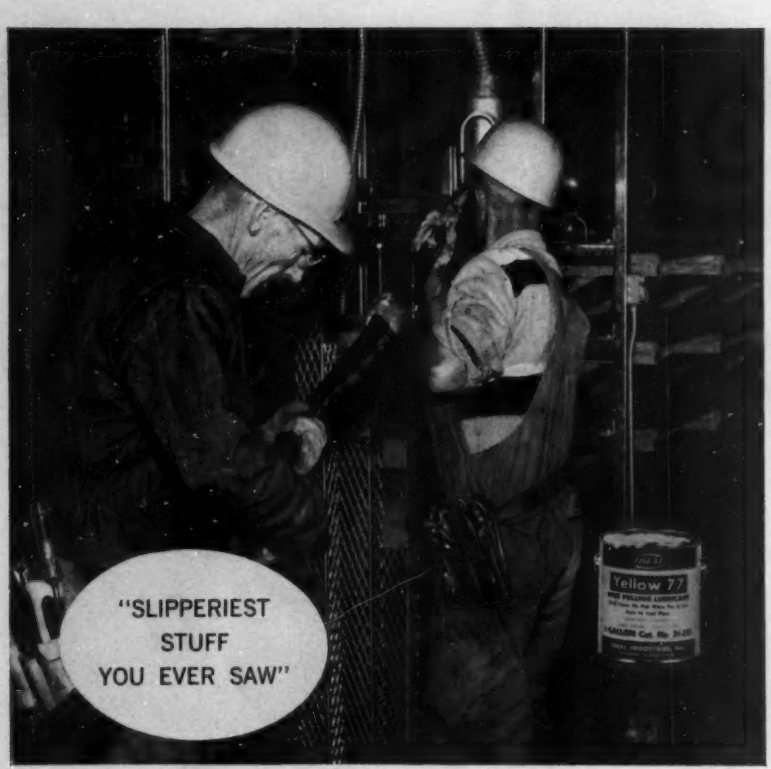

NEW IDEAL "YELLOW 77"

WIRE PULLING COMPOUND

Creamy textured, yellow color, not messy, "good" smell.

- works best where the pulling is toughest—all wire sizes—including 500 MCM and larger.
- spreads out on wires in long runs—it won't quit halfway through!
- a little goes a long way.
- safe for hands and insulation, not damaged by freezing, won't dry out in the can.

EASILY APPLIED by hand, brush or cloth. Wipes off hands easily. It doesn't "wash-off" when pulling through water in conduits. Can be used to pull wires through steel, fiber or aluminum conduit. Clings around sharp bends and corners. Available in quart and gallon cans, 5-gallon pails and 55-gallon drums.

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The editorial and business staff of ELECTRICAL SOUTH is eager to serve you. One way in which we can help you is to make it easy for you to draw upon the wealth of technical and promotional material available from manufacturers.

In the accompanying pages are the descriptions of scores of useful catalogs, application information booklets, and technical publications. These are available without charge.

Check over the list of publications available, indicate the numbers of the ones you want on the postage - paid card to be found on page 19, and mail it to us with your name, title, company and address plainly written. We will tell each manufacturer to send directly to you the information you want.

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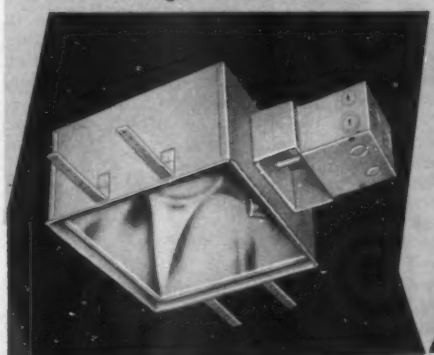

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MOE LIGHT

SQUARES

150-150-300 WATT

Featuring Frame-within-a-Frame Construction. Outstanding high quality. Best box available at competitive prices.

M-6646—100 watt—$4.22*
M-6648—150 watt—$4.82*
M-6623—300 watt—$8.22*

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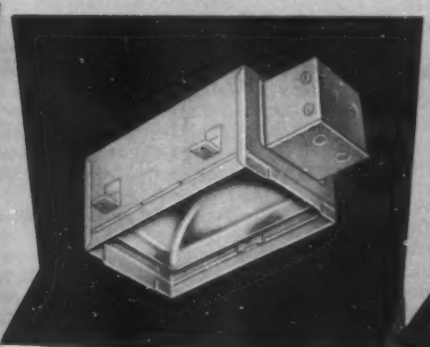

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MOE LIGHT

RECTANGULAR

60-100 WATT

Values to match Moe Light squares point for point in installations where shape is a factor.

M-5614— 60 watt—$3.87*
M-5616—100 watt—$4.27*

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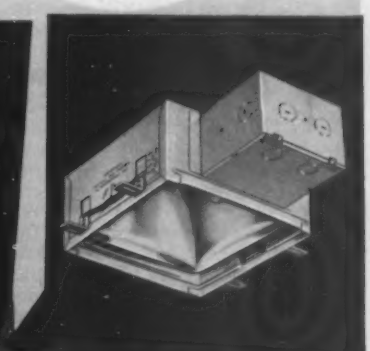

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STAR *Light*®

BUDGET SQUARES

100-150 WATT

Out-value competition in every way . . . especially low price . . . featuring snap-on bar hangers (included).

SL-2866—100 watt—$3.46*
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BUY 9—GET 3 FREE

*Housings only . . . glass and trim *not included*. Contractor-Dealer prices shown. Offer expires June 30, 1961.

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CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

HYDRAULIC EQUIPMENT—Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., has made available a catalog containing information on their lines of hydraulic derricks, cable reel carriers, and diggers. It is illustrated and contains data on design features, specifications, and application.

Write in No. A134 on card, pg. 19

CONDUIT AND DUCTS—Orangeburg Mfg. Co., Inc., 375 Park Ave., New York 22, N. Y. has made available informative literature. Catalog No. 52 includes complete details concerning advantages, installation, and properties of Orangeburg fibre conduit, standard conduit—type I, and Nocrete conduit—type II. Catalog 202 offers specifications, installation data, and diagram of the complete Orangeburg Underfloor duct system. Descriptions and catalog numbers of components are also given.

Write in No. A135 on card, pg. 19

ELECTRIC HEATING—A 34-page descriptive packet containing color illustrations and complete specifications of eight major types of electric heating units and controls is now available from Arvin Industries, Inc., Electric Heat Div., 13th and Big Four Road, Columbus, Ind. Both radiant and fan-forced heaters are included, in wall, baseboard, and ceiling models.

Write in No. A136 on card, pg. 19

WIRING DEVICES — Catalog No. 56, and New Products Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc., Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible use in Industrial, Commercial and Residential applications.

Write in No. A137 on card, pg. 19

CARBON PRODUCTS—A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

Write in No. A138 on card, pg. 19

LIGHTING FIXTURES—Progress Manufacturing Co., Castor Avenue and Tulip Street, Philadelphia 34, Pa., announces the publication of two new lighting catalogs. "Lighting by Progress," a 52-page booklet, describes their line of residential fixtures. "Home Lighting by Minute Mount" is a 12-page bulletin illustrating new ideas in budget lighting.

Write in No. A139 on card, pg. 19

CABLE, WIRE, AND CORD—Catalog 71A, punched for filing in looseleaf binder, has been made available by Carol Cable Co., Division of the Crescent Co., Inc., Pawtucket, R. I. Contained in its 24 pages is a complete listing of most of the types of wire and cable offered by the firm.

Write in No. A140 on card, pg. 19

ELECTRICAL EQUIPMENT—The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog 58' Guide, containing data on their line of Safety Switches, Service Equipment, Distribution Panels, "E-Z-RED" Circuit Breakers, interchangeable and non-interchangeable, also wiring troughs.

Write in No. A141 on card, pg. 19

POWER BENDER — The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

Write in No. A142 on card, pg. 19

ELECTRICAL FITTINGS—Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, traps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

Write in No. A143 on card, pg. 19

WIRING DEVICES — A complete new illustrated catalog and price book is now available from E. M. Wiegmann and Co., Inc., Freeburg, Ill., covering their line of outlet and switch boxes, cut-out and pull boxes, wireholders and racks, and service entrance equipment.

Write in No. A144 on card, pg. 19

COMPRESSION CONNECTORS — New and fully illustrated Bulletin 13 offered by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., shows their complete line of Squeezon compression fittings. They make all overhead distribution connections from line wire to ground rod on aluminum, ACSR, copper, or combinations of them. Application and installation data are given for tap connectors of several types; service entrance, splicing, jumper and repair sleeves; terminals, stirrups and ground fittings. Mechanical and hydraulic installing tools for both dead and hot line work are listed.

Write in No. A145 on card, pg. 19

WATER HEATING BOILER — Precision Parts Corp., 400 N. First St., Nashville 7, Tenn., has available a bulletin containing catalog information on their electric hot water heating boiler, diagrams of the boiler, and data on the advantages of its use. The boiler comes complete with water circulator and safety valve on models A through K.

Write in No. A146 on card, pg. 19

ADEQUATE WIRING — "Bright Ideas for Ladies" is the title of a new booklet from American Metal Moulding Co., 146 Coit St., Irvington 11, N. J. The booklet was prepared by the Armoured Cable Section of the National Electrical Manufacturers Association to acquaint homemakers with the electrical wiring their homes need for full electrical living now and in the future.

Write in No. A147 on card, pg. 19

ELECTRICAL CONDUITS — "National Electric Conduits" is the 20-page Catalog No. 603 which describes and illustrates the many types of electrical conduits manufactured by National Electric Div., H. K. Porter Co., Porter Bldg., Pittsburgh 22, Pa.

Write in No. A148 on card, pg. 19

TRANSFORMERS—R T & E Corp., 1900 E. North St., Waukesha, Wis., has available a bulletin describing Terra-Tran transformers for residential underground distribution. The 15-page booklet is illustrated and contains complete information on construction, application, and design features.

Write in No. A149 on card, pg. 19

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

ANCHORING DEVICES—An Illustrated 32-page catalog, No. 70, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

Write in No. A150 on card, pg. 19

CONNECTORS — Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 10-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

Write in No. A151 on card, pg. 19

ELECTRIC HEATING — Electromode Division of Commercial Controls Corp., 570 Culver Rd., Rochester 3, N. Y., is now offering their complete line of electric heaters and heating systems for the home. Descriptions, specifications and illustrations are included for wall and portable heaters for large and small rooms, radiant panel heaters, baseboard heaters and radiant cable heat.

Write in No. A152 on card, pg. 19

ELECTRICAL EQUIPMENT — A new 12-page pictorial bulletin briefly describes manufacturing facilities and electrical products of Crouse-Hinds Co., Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines; Condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control.

Write in No. A153 on card, pg. 19

CONNECTOR BULLETINS — Six new bulletins have been released by Ilsco Corp., 4730 Madison Rd., Cincinnati, Ohio. They cover the Ilsco line of solderless connectors, special connectors, lugs, neutral bars, crimp lugs, and the Ilsco Lok-A-Blok. The bulletins include descriptive material, dimensions, and packaging data.

Write in No. A154 on card, pg. 19

WIRE PULLING LUBRICANT — Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.

Write in No. A155 on card, pg. 19

FLUORESCENT FIXTURES—The new Miller Sabre fluorescent fixture is illustrated in the Sabre catalog, page 13, published by The Miller Company, Meriden, Conn. This page points out application, construction details, and dimensional, illumination, and installation data.

Write in No. A156 on card, pg. 19

TROFFER CATALOG—A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is information on ceiling lighting patterns, shielding designs, lighting techniques and applications.

Write in No. A157 on card, pg. 19

CONSTRUCTION ANCHORS — "Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

Write in No. A158 on card, pg. 19

SMALL WIRE STRAPS—Added to the one-hole Viking strap line are three new Midget straps for small wires. The #616 for fastening RX and UF 2/14, 2/12, and BX 2/14; the #416 for wires to 1/4" OD; and #316 for wires of 3/16" and 1/4". These galvanized straps, designed to take several sizes of wires; are featured in literature released by W. W. Cross & Co., Viking Cable and Fastening Devices, Greenville, R. I.

Write in No. A159 on card, pg. 19

RESIDENTIAL LIGHTING — A new catalog featuring their line of residential lighting fixtures has recently been issued by John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio. The 48-page booklet is illustrated and in color. It pictures and describes incandescent and fluorescent fixtures for every room in the house and every design motif.

Write in No. A160 on card, pg. 19

MODULAR LIGHTING—A twelve-page folder describing and illustrating their line of surfaced and recessed fluorescent modular fixtures is announced by Moe Light of Thomas Industries, Inc., Lighting Division, Brook & Broadway, Louisville, Ky. Complete coefficient of utilization and candlepower distribution tables are included for each set of fixtures.

Write in No. A161 on card, pg. 19

BUILT-IN HEATERS—Thermador Electrical Manufacturing Co., 5119 District Blvd., Los Angeles 22, Calif., has announced the availability of three new catalog sheets on their line of built-in electric heaters. The heaters described are their portable radiant-fan heater, electric ceiling heater, and baseboard electric heater.

Write in No. A162 on card, pg. 19

CABLE SUPPORTING TRAYS — The Globe Co., 4000 South Princeton Ave., Chicago 9, Ill., has made available a new catalog on their line of cable supporting tray systems and accessories. The catalog contains information on design features, specifications, and installation.

Write in No. A163 on card, pg. 19

CONDUIT — With Rigid Polyvinyl Chloride Electrical Conduit gaining increasing popularity in the electrical field, Kraloy Plastic Pipe Co., Inc. offers a new, complete 20-page catalog. Included are comprehensive test results, specifications information, installation instruction, corrosion resistant charts, and other valuable data. Write Kraloy Plastic Pipe Co., Inc., Electrical Conduit Division, 402 West Central Avenue, Santa Ana, California.

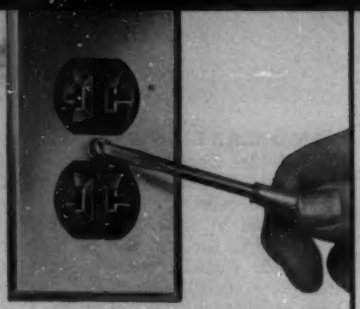
Write in No. A164 on card, pg. 19

SWITCH & OUTLET BOXES AND ELECTRICAL FITTINGS — Catalogs B-960 and F-960 respectively feature the latest in switch and outlet boxes and electrical fittings. Completely illustrated, they contain over 100 pages of technical and informational data. A unique set of indexes in the fittings catalog make it the easiest reference catalog in its field. Available from the Electrical Fittings Corp., 37-50 57th St., Woodside 77, New York.

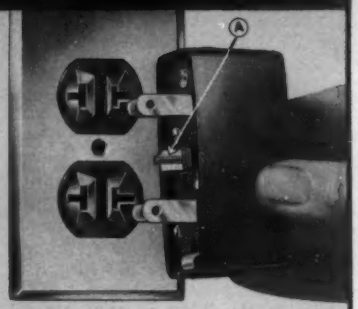
Write in No. A165 on card, pg. 19

HUBBELL DUPLEX ADAPTER

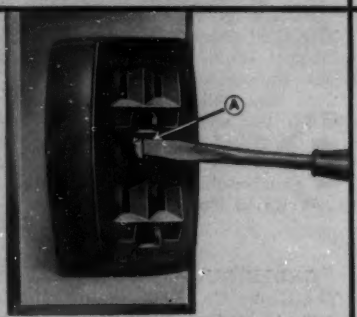
15 A., 125 V.



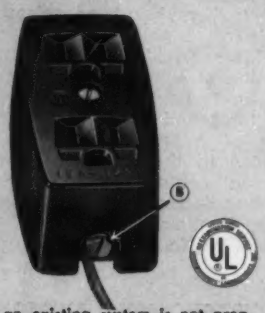
Hubbell Duplex Adapter No. 5291 is easy to attach. Just remove screw holding metal or plastic plate to 2-wire receptacle. Leave plate in place.



Adapter plugs into 2-wire receptacle. Screw A will go through plate to grounded box. It is connected to both U-slots of adapter.



Tightening Screw A establishes adapter ground in a grounded system. If the system is ungrounded, connect adapter as shown at right.



When an existing system is not properly grounded, the adapter may be grounded by connecting a grounded wire to green hex Screw B.

FAST TEMPORARY CONVERSION TO 3-WIRE GROUNDING SAFETY

This polarized, plug-in adapter converts 2-wire duplex receptacles used with grounded or ungrounded systems to temporary 3-wire grounding receptacles. Landlords find it a great convenience when tenants requiring 3-wire facilities cannot postpone occupancy until rewiring is completed.

To make a conversion, nothing in the existing system has to be removed except receptacle cover-plate screws, to make room for a captive screw in each adapter. This captive screw acts as a conductor from the two U-slots to the grounded system. For use with receptacles in ungrounded systems, there is a green binding screw to permit connection of an independent ground wire. Either way, the electrically independent blades and contacts continue existing split circuits.

The polarized adapter operates in any parallel or T-slot duplex receptacle with metal or plastic cover plates. Brown or ivorine bakelite, for 15 amperes, 125 volts. Size: 1.4" from plate, 3.3" high, 1.75" wide.

HARVEY HUBBELL INCORPORATED

Bridgeport 2, Connecticut

In Canada: Scarborough, Ontario

Wanted: Manuscripts for publication

The editors of Electrical South will welcome contributions from the field for publication. Electrical contractors, consulting electrical engineers, light and power company engineers, and others closely associated with the electrical industry are invited to submit articles, photographs, and drawings relating to important and interesting electrical projects in the South and Southwest.

Articles are wanted in two principal classifications:

Wiring and Lighting: **Articles on interesting and unusual electrical installations; any phase of electrical contracting such as business promotion, estimating, handling men and materials, etc.**

Utility Engineering: **Articles relating to any phase of transmission, distribution, and metering, including design, installation, testing, and maintenance. These articles should be "by-line" articles carrying the name of a Southern or Southwestern light and power company.**

All articles will be given careful consideration and payment will be made promptly for all material accepted for publication.

Address all communications to the editor:

Electrical South
1760 Peachtree Rd., N. W.
Atlanta 9, Ga.

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Now you can trace conductors in cables and conduit– *10 times faster* than ever before–and leave your helper free to finish other jobs quickly and profitably. A tracing *system* in itself, revolutionary new CABLE TRACER lets you search–and *unmistakably identify*–up to 10 separate circuits simultaneously, even in the dark and when color coding is absent or obscured by age and dirt. It can also test for opens and shorts.

CABLE TRACER is a completely self-powered precision tool which forever eliminates the need for clumsy buzzers. Designed by the makers of famous AMPROBE snap-around test instruments, new CABLE TRACER is simplicity itself to use. At the press of a button, a number lights up to identify the conductor. What's more, CABLE TRACER will pay for itself in saved labor costs after only three jobs. It is supplied with three test leads and ten Station Blocks in a belt-looped carrying case made of top-grain cowhide leather. Test-try CABLE TRACER today; your AMPROBE Distributor has a live-action demonstrator. Or write for free Catalog Sheet CT-10.

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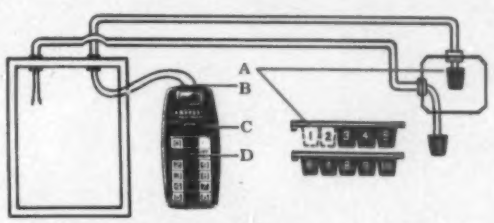

1. Simply plug one end of conductors to be traced into numbered Station Blocks (A).
2. Plug other ends into Receptacle (B) at top of CABLE TRACER.
3. Press Indicator Button (C).
4. The number on CABLE TRACER's Indicator Panel (D) corresponding to the Station Block at the other end of the conductor being traced (No. 1, in this case) *lights up* to provide identification–instantly, clearly, unmistakably! Using all the Station Blocks, ten conductors can be traced at one time.

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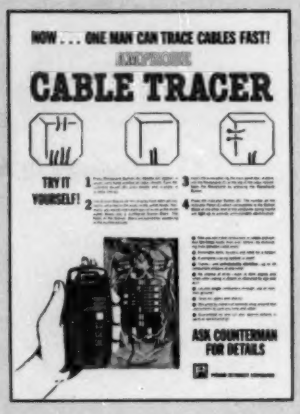

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Send free information on these ADVERTISEMENTS:

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Electrical South
1760 PEACHTREE ROAD, N. W.
ATLANTA 9, GEORGIA

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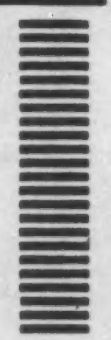


Connect COPPER with COPPER ALUMINUM with ALUMINUM use...

PAC-5
ACSR 6—1/0 Cu. 8—1/0

For complete information and test data: Send for Bulletin #6007

Patent #2,795,770

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4 6—1 0 A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive patented method of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

AVAILABLE THROUGH ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORPORATION

1525 WOODSON RD. • ST. LOUIS 14, MO. • WYdown 3-9430

For more details on above items, use reply card on page 19

THE RED HANDLE SAFETY SWITCH GOES RAINTIGHT

Removable cover and convenient "stay-up" cover catch for easier wiring. Contacts are plainly visible. Complete light and heavy duty lines available from 30 to 600 amperes.

Rain, sleet or snow, General Electric's new outdoor safety switches give the same reliable performance as the indoor models.

They're extra safe. The gasketed handle protects the operating mechanism for the life of the switch. The safety phase barrier protects against accidental contact. There are no fiber linkages in the mechanism to deteriorate with age, moisture or heat.

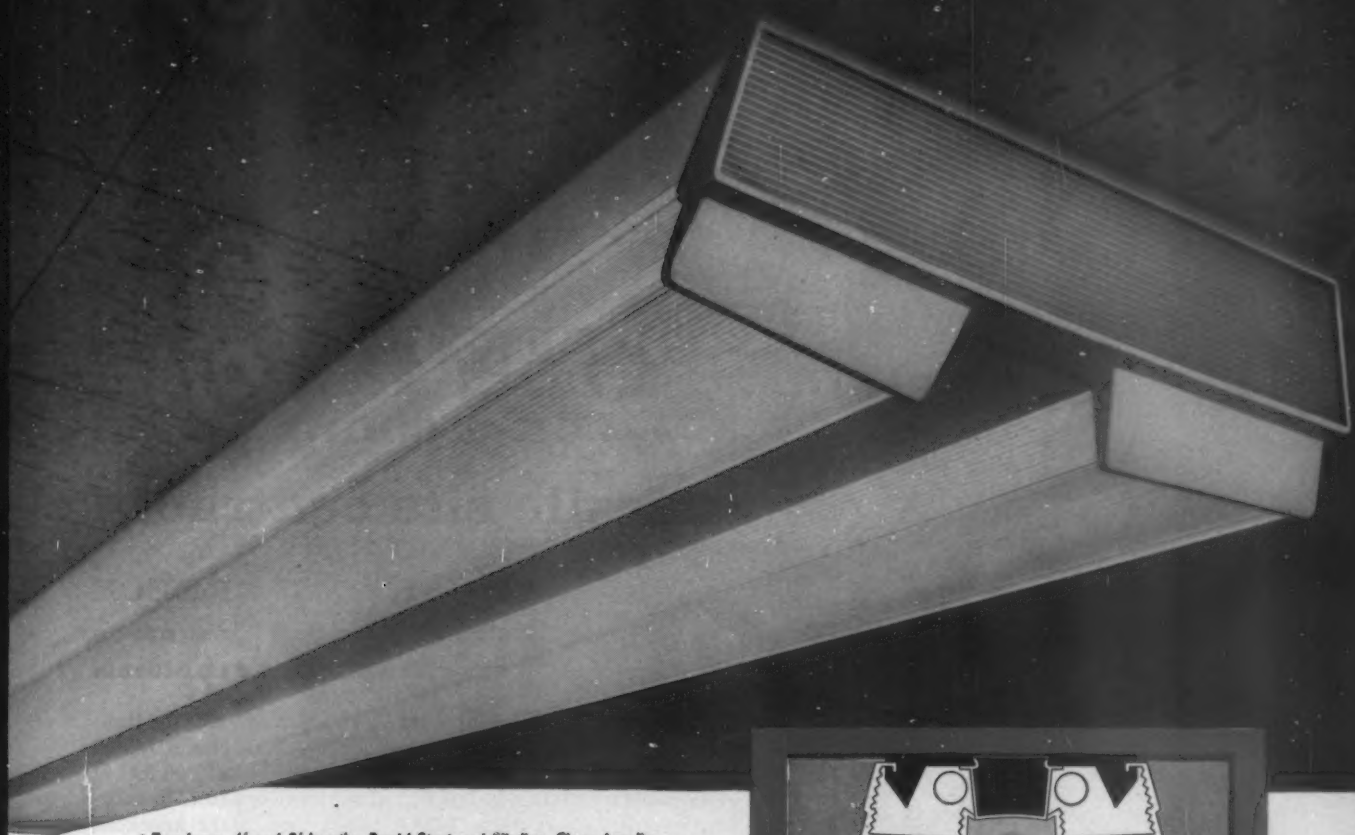
They're easy to install. Cover can be removed with only two screws. Convenient cover catch flips up at finger touch, stays up when two hands are needed for wiring. Mounting holes are raised for easy installation on uneven surfaces. Available in ratings from 30 to 600 amps, 240 and 600 volts, A-C. Write for bulletin GEA 6756 or see your G-E Distributor. Circuit Protective Devices Dept., Plainville, Conn.

GENERAL ELECTRIC

More seeing comfort by design . . .

NEVER BEFORE, SO MUCH SEEING COMFORT AT SO LITTLE COST *In a Plastic-enclosed Fluorescent Fixture for Surface Mounting*

Duplex-a-lite®
LIGHTING by miller



- Two lamp, 4′ and 8′ lengths; Rapid Start and Slimline. Clear Acrylic or light stable Polystyrene lenses. 13⅜" width.
- Self Hinging Plastic Enclosure for Each Lamp supported on both edges by continuous flanges in channel—Easy to Maintain—No Sag.
- Cooler Lamp and Ballast Operation—each lamp has its individual compartment widely separated by exposed metal channel which acts as a heat dissipator.

This altogether new and different looking fixture is a precision lighting tool, optically designed for optimum *seeing comfort* and economy . . . a performance feature we call Opticomfort. Duplex-a-lite controls and evenly distributes the right amount of the right kind of light where it's needed most . . . puts more usable light on the work or merchandise—less in the eyes. It is especially suitable for schools, offices, public buildings and stores . . . wherever there's a need for *seeing comfort* over prolonged periods of time.

A truly unique combination of fresh, trim appearance and *seeing comfort* at a *modest* price . . . a natural for on-the-ceiling mounting in newer buildings where ceilings are low.

For complete information, write Dept. 661 S, or contact your Miller Representative.

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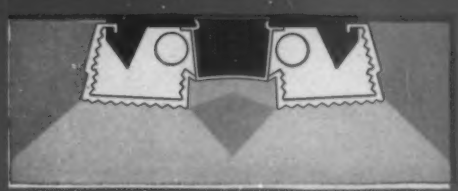


Opticomfort BY DESIGN

Another Miller First! Twin compartments separate and house each of Duplex-a-lite's two lamps in a unique manner that enables the optically designed, prismatic lenses to limit and control most of the light within the highly critical 45°-90° viewing zone. This assures optimum seeing comfort, or Opticomfort. Ceiling and center channel cover are softly illuminated. Enclosures of rigid plastic require no shadow-causing interior framework.

*Trademark Patent Pending

LIGHTING BY miller SINCE 1844

THE **miller** COMPANY
MERIDEN, CONNECTICUT • UTICA, OHIO

JOB-PROFIT TOOLING IDEAS

FROM GREENLEE

"We saved several thousand dollars with GREENLEE TOOLS on a complicated missile site contract,"

says FRED S. BREECE

superintendent of electrical construction for A. NERI, Inc., of California

A. Neri, Inc., of California, is the electrical contractor for three Titan missile-launching complexes near Mountain Home, Idaho. Specifications for this job call for approximately 345,000 feet of rigid conduit and over 90,000 feet of thin-wall conduit. Installation requires more than 14,000 bends and 2,000 knockout openings for distribution and junction boxes.

Ralph Neri, assistant superintendent on the job, reports, "We are using Greenlee benders, knockout punches, and punch drivers exclusively. In most cases we have been able to take the tools right to the conduit instead of taking the conduit to the tools . . . and get the job done faster."

This view (right) of one of the missile-launching sites gives some idea of the complexity of this job. The cylindrical structure still in the forms is the entrance portal for the entire complex. The concrete dome will house the control center. When the work is completed, all these structures will be completely underground.

Work area in the tunnels and other structures in the missile-launching complex is so limited that A. Neri, Inc., set up a prefabricating shop where bends in various diameter conduit are made on Greenlee benders. The finished bends are then taken to the construction site for installation, substantially reducing the man-hours required to complete the job. Two No. 884-E one-shot benders with 4″ capacity, and powered by Greenlee No. 798AC-SA two-speed hydraulic power pumps, are used in this prefab shop.

Bending conduit right on the job is done on three Greenlee No. 880-M2 benders like the one shown above. Breece reports the light weight and compactness of these tools are a definite advantage to job efficiency in the confined work areas of the tunnels. All benders are operated either by Greenlee hydraulic hand or power pumps. According to Breece, there have been no major repair or maintenance costs with any of their Greenlee tools — another big saving for A. Neri, Inc.

To complete this job, workmen for A. Neri, Inc., will make over 4,000 bends in 90,000 feet of ½″ through 2″ thin-wall conduit, using three Greenlee No. 880-M2T thin-wall benders (as pictured above).

For total bending work on both thin-wall and rigid conduit on this contract, Breece estimates his company will save several thousand dollars through the use of Greenlee benders.

"We also should save by using Greenlee knockout punches and drivers," Breece states. To speed the work of making over 2,000 knockout openings for ½″ through 4″ diameter conduit, A. Neri, Inc., is using Greenlee No. 7310 hydraulic knockout driver and punch sets (as shown above), Greenlee No. 1731 one-shot knockout punch driver, and the No. 1804 ratchet knockout driver.

Greenlee equipment used for this contract was purchased from National Electric Supply Company, Oakland, California, whose representative worked closely with A. Neri, Inc., in providing the right tools for each job.

For help in selecting the exact GREENLEE JOB-PROFIT TOOLING needed to streamline *your* operations, help control costs, and assure a better return on your tool investment, see your Greenlee distributor . . . or write for Bulletin E-240A today.

GREENLEE TOOL CO.
1955 Columbia Ave., Rockford, Illinois

TOOLS FOR CRAFTSMEN
GREENLEE

JOB-PROFIT TOOLING

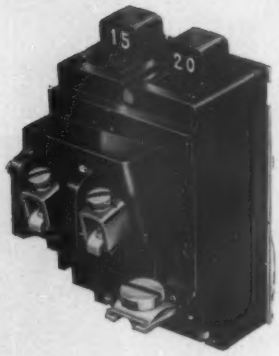
. . . cost control for contractors

KNOW YOUR SYMBOLS

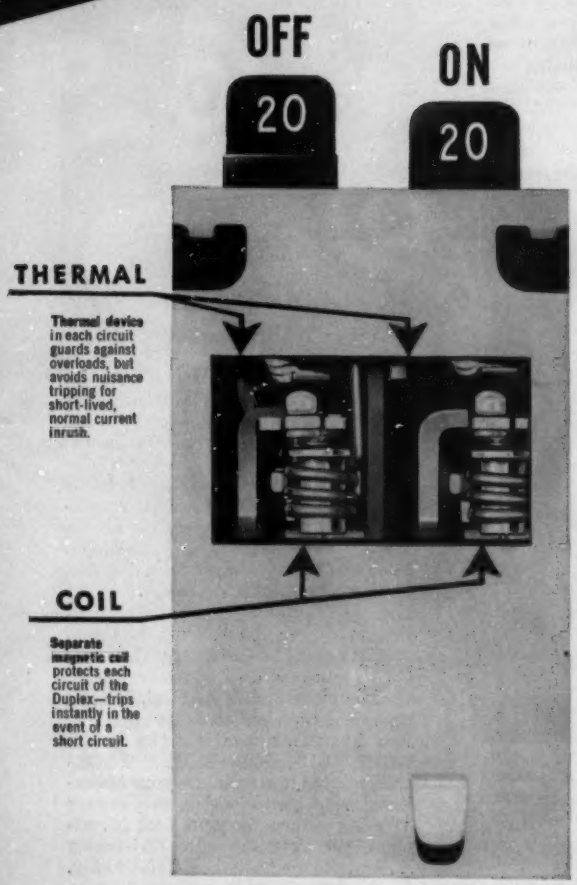
This symbol stands for circuit breaker

This symbol stands for QUALITY

BullDog Duplex Pushmatic—



Still the leader in residential safety and convenience!


OFF
ON
20
20
THERMAL
Thermal device in each circuit guards against overloads, but avoids nuisance tripping for short-lived, normal current inrush.
COIL
Separate magnetic coil protects each circuit of the Duplex—trips instantly in the event of a short circuit.

The leader in safety . . . BullDog's Duplex Pushmatic® circuit breaker provides two protective systems in each circuit. A thermal control teams up with a magnetic coil to assure maximum protection under *any* residential operating condition and to avoid nuisance tripping. Bolted bus-bar connection assures tight, positive contact that prevents overheating. This maximum electrical safety is your best protection against costly trouble calls!

The leader in convenience . . . the Duplex Pushmatic puts two general-purpose circuits, 15 or 20 amps, in the panel space of one—provides maximum circuit flexibility with smaller, less expensive panels. And the Duplex is the *only* breaker with exclusive pushbutton convenience. Also, a tripped breaker can be identified instantly by sight or touch, resets with a push of the finger. For complete details on Pushmatic breakers and panels, write for your "Pushmatic Pocket Guide"—*it's free!*

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION

Contact the I-T-E Office in your locality for additional product information and service.

L & P Lighting Serves Its Agents

L & P's "partnership in business" begins with its own agents. They are the vital link between L & P, as manufacturer of fluorescent and incandescent lighting fixtures . . . and the distributors and their customers. For this reason, our agents are always welcome at the L & P plants in Olive Branch, Miss., and Memphis, Tenn. In fact, we make it a point to see that they visit us from time to time.

As a result, you'll find L & P agents know their products exceptionally well, from knockouts to ballasts, from lumens to louvers. You'll find that L & P agents are proud of their fixtures, too—for they know from personal experience that only the best of craftsmanship, materials, and performance emerge from the L & P assembly lines.

WHATEVER YOU NEED IN LIGHTING FIXTURES, ASK YOUR L & P AGENT. HE IS TRAINED, EXPERIENCED, AND DEDICATED TO SERVE YOU. YOU CAN TRUST HIM.

LIGHT & POWER UTILITIES CORP. L&P

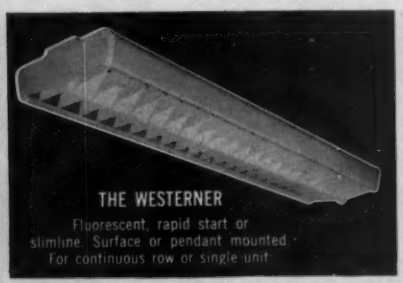
L & P LIGHTING

OLIVE BRANCH, MISS.

1035 FIRESTONE BLVD. • MEMPHIS, TENN.

"LIGHT-UP" with L & P Lighting

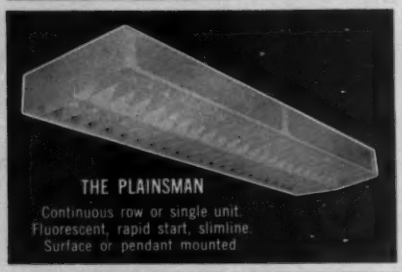
THE PEABODY
For continuous row or single unit installation—fluorescent, rapid start or slimline.



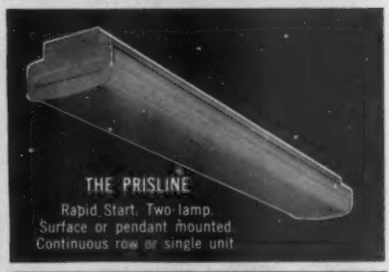
THE WESTERNER
Fluorescent, rapid start or slimline. Surface or pendant mounted. For continuous row or single unit.

THE EXPLORER
Enclosed commercial, 2 and 4 lamp, surface or pendant mounted.

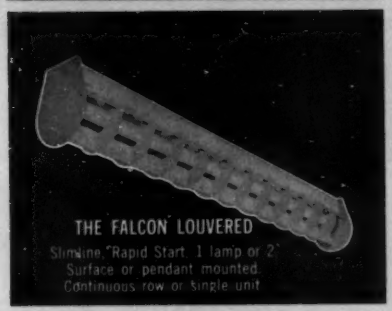
THE LP INDUSTRIAL
Fluorescent, Rapid Start. Surface or pendant mounted. Continuous row or single unit.



THE PLAINSMAN
Continuous row or single unit. Fluorescent, rapid start, slimline. Surface or pendant mounted.



THE PRISLINE
Rapid Start. Two-lamp. Surface or pendant mounted. Continuous row or single unit.



THE FALCON LOUVERED
Slimline, Rapid Start. 1 lamp or 2. Surface or pendant mounted. Continuous row or single unit.

PENDANT MOUNTED UP-DOWN LITE
Heavy gauge aluminum. Perforated. Non-twist stem, hang straight aligner.

SURFACE OR SEMI-RECESSED SQUARE
Vandal-proof, Tamper-proof, Weather-Resistant.

CONCENTRIC RINGS
Seamlessly butt-welded steel. Heavy gauge aluminum canopy. Aluminum non-reflecting baffle.

DOME LITE
Heavy gauge spun aluminum. Available pendant, surface or recessed.

BRACKET LITE
Cast aluminum. Moisture and vapor resistant. White opal globe.

Here are only a few of the quality fixtures in L & P's complete line of fluorescents and incandescents—everything from open and enclosed commercials, industrials and strips, corridor lights and troffers, to illuminated ceilings, concentric rings, bracket and dome lights, rounds and squares. For beauty, efficiency and economy, order L&P fixtures.

For complete catalog and price lists, write

L&P LIGHTING
Olive Branch, Mississippi

here it is! A REAL
ONE-HAND TOOL

installs
INSULINK® and LINKIT®
one crimp per end!

You'll like this ONE-HAND TOOL ... from start to finish, you can really work it with only ONE HAND. You can close it with less than a 50 lbs. squeeze; it weighs only 2½ lbs. and is only 12" long. You couldn't ask for an easier service tool ... it's the only *real* ONE-HAND TOOL.

Position the OH25 once ... and only once ... on each side of the INSULINK or uninsulated LINKIT. It has a new die that crimps the entire contact area at one time. You don't have to reposition, you can't overlap crimps, and you never make less than the proper number of crimps.

And, it takes only ONE CRIMP PER END ... a series of easy, ratchet controlled strokes to make a perfect crimp every time. The new dies cause the conductor strands to rub together, removing the oxide film for more stable, low resistance connections.

Insert stripped wire ends into INSULINK; caps grip and hold conductors.

Get up close to your work. Position ONE-HAND TOOL on INSULINK only once per crimp.

A series of easy strokes comple... the crimp. Dies produce oxid... removing wiping action betwee... conductor strands.

ANOTHER MAJOR DEVELOPMENT IN THE

BURNDY

COMPRE...ION PROGRAM

NORWALK, CONNECT. BICC—BURNDY Ltd. Prescot, Lancs., England In Continental Europe: Antwerp, Belg... TORONTO, CANADA

ROLL CALL!

Check The Record

☐ More miles in use underground than any other fibre conduit. ☐ oldest installations ☐ some go back 60 years and are still going strong. ☐ wide acceptance... ☐ by power and light utilities ☐ by telephone companies ☐ general contractors ☐ industry ☐ also by cities and municipalities ☐ first fibre conduit—we introduced it in 1893. ☐ first C. A. Conduit (coupling attached) ☐ first Klean-Kote for cleaner handling.

When anyone pays us the compliment of calling some other make of fibre conduit "orangeburg type" please remember that "orangeburg type" does not mean Orangeburg Brand Fibre Conduit. That's the brand and quality made by us alone.

Vital electrical cables deserve the best protection and we have spent nearly 70 years trying to make Orangeburg Brand Fibre Conduit the best that money can buy.

"No substitute is as good as the regular" it tries to replace.

KLEAN-KOTE*

ORANGEBURG®

BRAND

FIBRE CONDUIT

FLINTKOTE®

*KLEAN-KOTE IS A TRADE-MARK, U. S. PATENT APPLIED FOR.

Orangeburg Manufacturing Co., Orangeburg, New York. Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products
Orangeburg Klean-Kote is distributed by Graybar Electric Company and General Electric Supply Company with Branches and Stocks in Principal Cities.

Bring out the best in Electric Heating with Honeywell quality controls

The new Honeywell T462 Line Voltage Thermostat offers the very finest for your economy-minded customers. A beauty in any room, this compact new thermostat gives dependable, worry-free performance—high load capacity plus accuracy and responsiveness. The new T462 was especially developed for electric heating, with a control range from 40°-85° with less than one-half degree differential. The T462 offers everything you could ask for in a quality-built line voltage thermostat.

Honeywell

First in Control

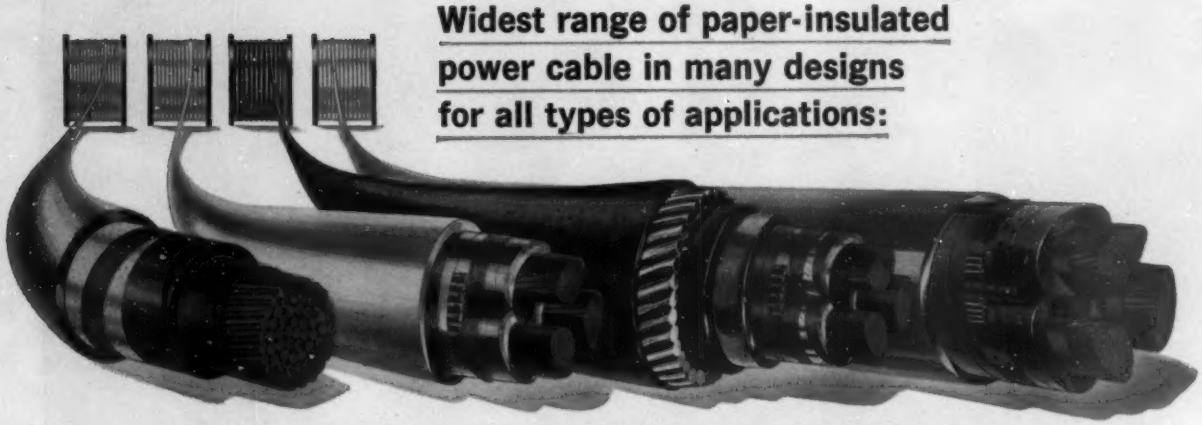
SINCE 1885

T462A—SPST Switching With Manual Single-Line Break in "No-Heat" Position.
T462B—SPST Switching With Manual Double-Line Break in "Off" Position.
For complete data on these and the complete line of low voltage controls, write Honeywell, Department ES-6-13, Minneapolis 8, Minnesota.

For more details on above items, use reply card on page 19

For a complete line of Electric Cable from one dependable source... specify PHELPS DODGE!

Widest range of paper-insulated power cable in many designs for all types of applications:



● **Solid** ● **Low Pressure** ● **Medium Pressure** ● **High Pressure**

Phelps Dodge paper-insulated power cables have a demonstrated record of long life service in a great variety of designs for all kinds of installations—underground duct, direct burial, submarine and aerial. Cables can be supplied with lead or aluminum sheaths.

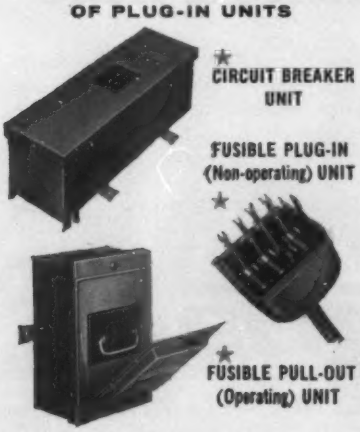
PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N. Y.

MINE TO MARKET

EXTEND ANY PRESENT BUSDUCT SYSTEM TO ANY SPOT IN THE PLANT FOR LESS THAN THE COST OF WIRE & CABLE!

Midget Busduct delivers instant power for equipment as easily as plugging in an extension cord!
Fast installation! Patented boltless pressure connectors slip over busbar ends for a tight, firm contact that allows for maximum expansion and contraction.
FRANK ADAM
Power Plug-in MIDGET BUSDUCT

CHOOSE FROM THREE TYPES OF PLUG-IN UNITS



100-Amp. plug-in power fed from existing busduct to any location with MIDGET BUSDUCT

Although the initial price of Midget Busduct is slightly more than wire and cable, the saving on labor alone results in a surprisingly lower installed cost.

No cutting or bending, no threading of conduit is necessary with Midget Busduct. It is 100% salvageable when plant layouts are changed, or machine relocations are made. Quick availability of plug-in units permits load connections in minutes to save even more on labor.

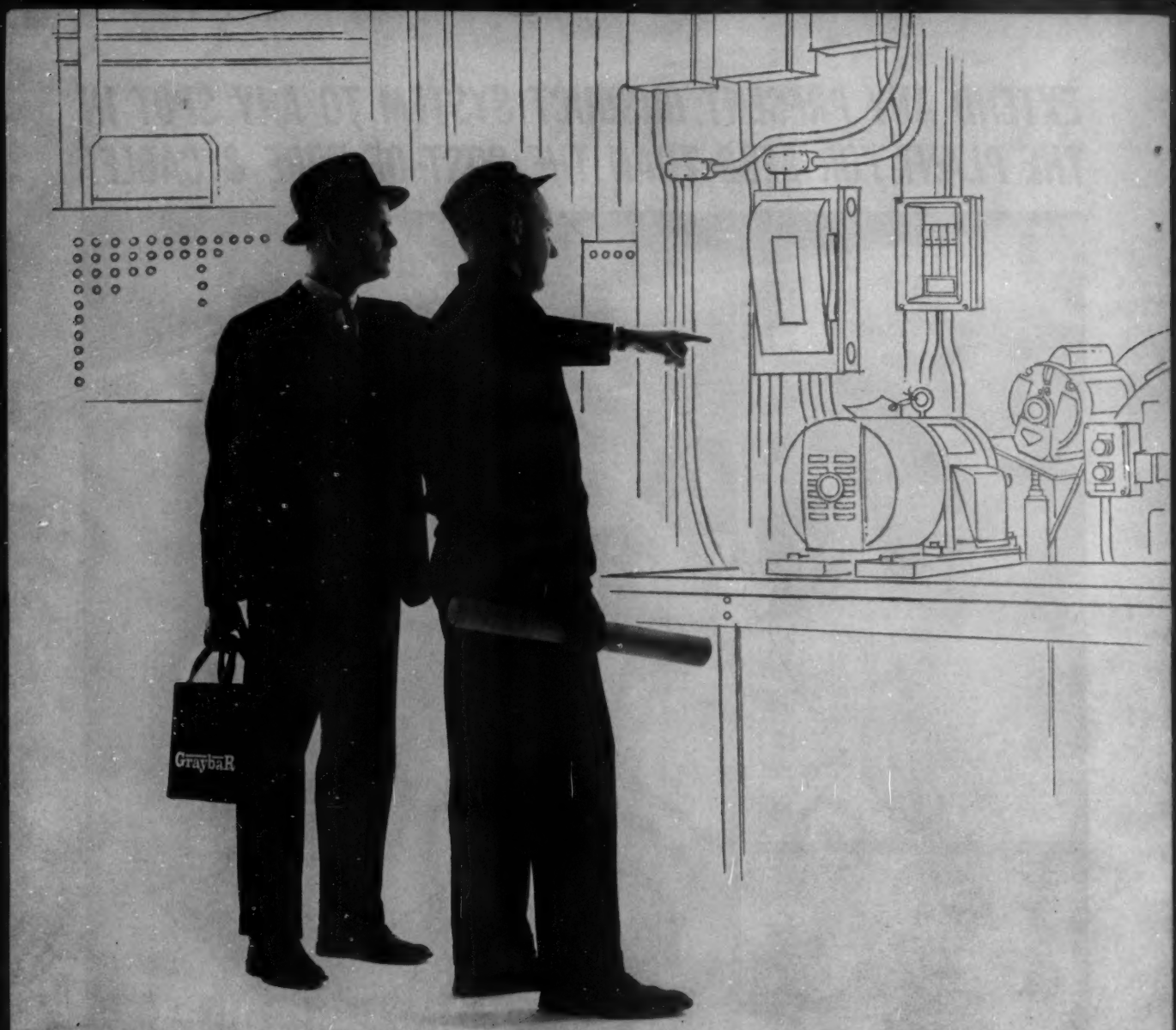
Either copper or aluminum conductors can be furnished. Midget Busduct has plug-in outlets every 10", on one or both sides, to accommodate three types of plug-in units, shown at left, in 30 to 100 amp. capacity. *Ask for complete information and prices.*

FRANK ADAM ELECTRIC COMPANY
SINCE 1891
P O BOX 357, MAIN P.O. • ST. LOUIS 66, MO.

KEEP PACE WITH ELECTRICITY

busduct • panelboards • switchboards • service equipment • safety switches • load centers • Quikheter

For more details on above items, use reply card on page 19



"Simple enough change and really cuts installation time"

You hear comments like this quite often when the Graybar Specialist joins an electrical contractor on the site.

The Graybar Specialist, backing up the salesman who calls, is there to work out the best installation method, to select equipment that's exactly right for the job, or show how to get the most from a special new tool.

He's well qualified to make this kind of assist, too. He's had years of training on the job and by the book. Working out a better way is almost second nature to the specialist.

And remember, he's just one of several members of the Graybar electrical contractor service team. The others: the Graybar Field Salesman, Inside Salesman and Counterman. Their job is to *speed your work . . . reduce your costs . . .* help you *build your business.*

The Graybar service team is ready to work for you. Call them in. 916

Graybar Service includes: Objective recommendations. On-the-job technical help. Most complete lines. Planned stocks to meet your needs. Expert counter service. Speedy handling of will-calls.

GraybaR

ELECTRIC COMPANY, INC.

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • OFFICES IN OVER 130 PRINCIPAL CITIES

GRAYBAR Everything Electrical GraybaR ELECTRIC COMPANY

a complete NEW family of Bulletin 709 Motor Starters

A-B QUALITY

the greatest advance in motor control in 30 years

From their amazing compactness to their almost unbelievable operating life—measured in *millions* of operations—this entire family of Bulletin 709 solenoid starters is *new in every detail.* They feature a new, patented, high-efficiency magnet—new molded coil—new hot molded arc hood—new weld-resistant contacts—and new truly *trip-free* and *tamperproof* overload relays. But these new starters use the old Bulletin 709 heater elements. Write today for all the details on this really amazing new line of Allen-Bradley Bulletin 709 motor starters.

Note the "family" likeness and aristocratic appearance of the new enclosures designed by Brooks Stevens

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

Allen-Bradley Co., 1305 S. First St., Milwaukee 4, Wis.

Big project

Every move must

This article should be especially helpful to the following readers:

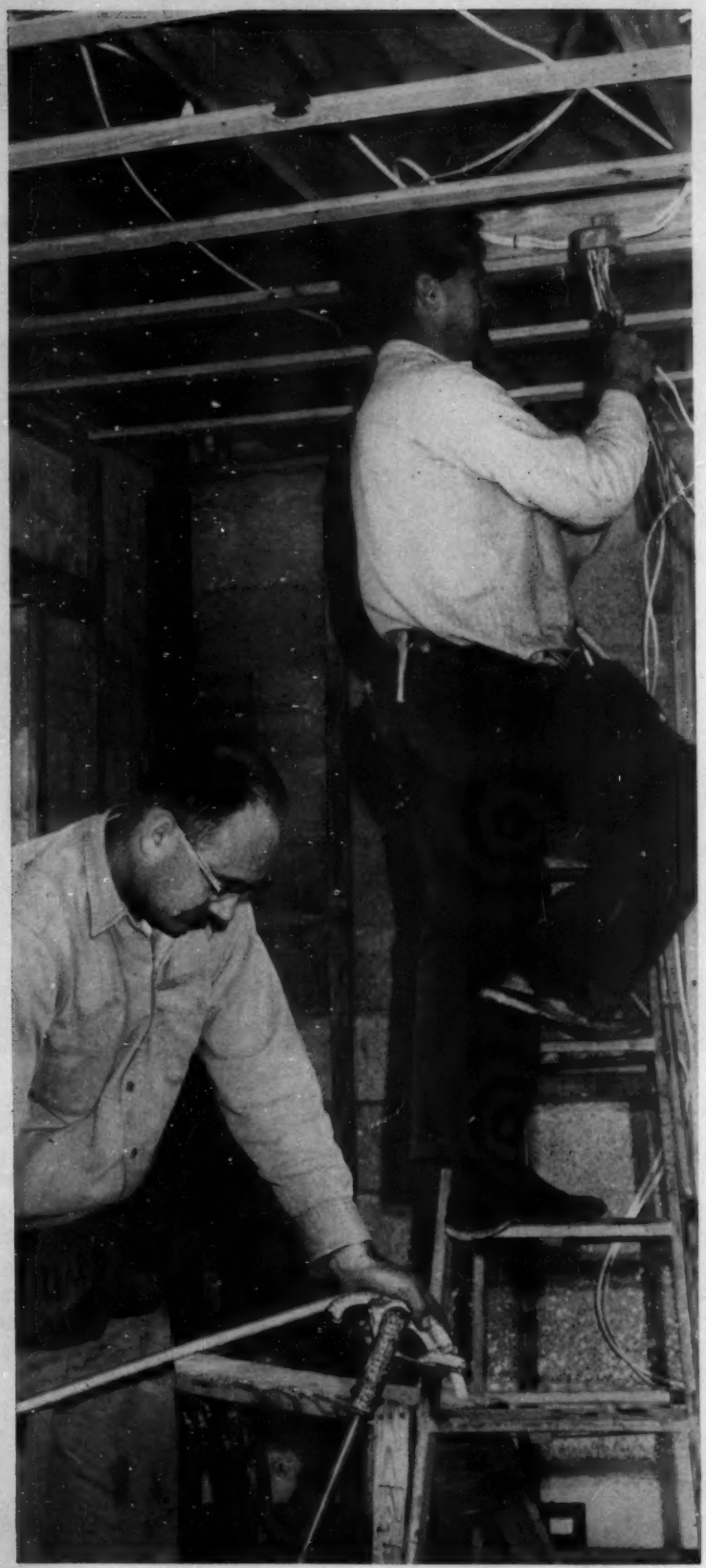
- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers

By Harry J. Miller, Electrical South Field Editor, Sarasota, Fla.

◆ "When you're riding herd on a fast-moving job, you've got to make every move count!"

So says H. E. Elwood, president of Port Charlotte Electric Co., whose crews wire from six to 20 houses a day at Port Charlotte, Fla., one of the nine giant communities being developed by the Mackle Corporation for General Development Corp.

Sometimes contractors complain that they can't pay high union



The same men work together job after job, perform as efficient team.

Gleaming white vehicles and an attractive office characterize efficient methods that Port Charlotte Electric Company uses.

demands mass-production wiring

count when contractor wires up to 20 houses a day in new community

wages, use good materials, and still be competitive with a non-union shop paying lower rates.

Mr. Elwood derides the idea. With homes realistically priced for the average buyer, and because Mackle's profit-per-sale is low and the company operates like a chain store or supermarket, selling in quantity at the lowest prices consistent with quality, it follows that wiring for such an outfit entails management and wiring efficiency of the highest caliber.

"We figure," says Mr. Elwood, "that by employing union labor we're getting qualified men. Sure we may not know their capabilities as wiremen, but we're confident that the people the union sends us have the necessary experience for the job.

"Such assurance of qualified personnel goes a long way toward solving our labor problem. Having the men for our work, it then becomes our objective to see that we get a day's work for a day's pay. This entails having materials on the job *before* they're needed so that when a journeyman gets there, all he has to think about is doing his wiring chore."

House wiring, performed at a speed that is truly impressive, characterizes the operations of Port Charlotte Electric. It stems from backing up effective planning with solid performance by trained crews. The firm's actions indicate its knowledge that labor efficiency is more than just wiring a house quickly; efficiency is how much work is produced with the labor that is available.

"The main point," says Mr. Elwood, "in our type of operation, is to forestall any duplication of effort."

"For example," says Ed Covington, manager of Port Charlotte Electric, "by our system, every mechanic—and we use no lesser grade workers—reports to the shop every morning at 8:00. In minutes he's on his way to the job, aboard a truck preloaded with all the supplies he'll need. We have no group of men milling around the shop and wasting time in social conversations or in a hunt for materials.

"Each mechanic also reports back at 4:00 p.m., half an hour ahead of quitting time, bringing along his truck for replenishing."

Mr. Elwood's stockman, Bud Orcutt, reports long before 8 a.m. His job is to assemble all the merchandise needed by the trim crews for the houses they are to wire that day.

The material for each house is placed in a box, which is placed in a van, and that box is the first thing that comes off the van upon its arrival. It is immediately brought into the house where it serves as the center of operations.

In advance of this, Mr. Covington and his foreman, Gene Win-

Each box is the center of wiring activities; each man has his allotted task and does it quickly.

gate, have made the rounds of this mammoth housing project. They've checked the houses ready for wiring; their type, lot, and block number, and they've made up a list of the materials needed.

This list goes to stockman Mr. Orcutt as a guide. If any extras have been specified for a particular house, Mr. Orcutt is so informed so he can make sure the extra material is included in the boxes which go into the vans.

Sufficient material

Each van carries enough material to wire 20 houses without having to return to the shop. This roughing-in material includes conduit, Romex, wire, and panels. Small houses get 100-amp service; larger homes 150-amp.

Leaving the shop in the morning, each van carries from four to eight mechanics, and includes a layout man. The van is backed up to a house, or if a number of houses are completely framed and ready for rough-in, the van is pulled between the houses. Immediately, the box containing the trim materials is carried in.

At once, the layout man, following a blueprint of the job, uses black crayon to mark the location for the panel, outdoor, and through-the-roof service; switches; and all outlets.

Other crew members are carrying in and laying out the conduit, bringing in the wire and other supplies and tools, and stringing a cable from the house to the 1,500-watt gas-driven generator in the van to supply electricity for power tools. No time is lost setting up a pole for temporary power.

Outlet locations marked

By this time, the layout mechanic has marked up all the outlet locations, and one man begins drilling holes in studding, rafters, and walls, while another mounts boxes on the block walls, using concrete nails, and cuts conduit to suitable lengths for installation in walls.

In the meantime, another worker is nailing outlet boxes on the wooden partitions.

Within 15 to 20 minutes, the layout man's chore is completed, and so is the hole driller's part of the job. Together, these two begin pulling wire, and after the two men finish nailing up boxes on the inside and outside of the house, they, too, pull wire, make joints, and run the service until the job is done.

That ends the rough-in. The layout man checks for any possible omissions and the crew then moves to the next house.

After the house has been plastered and painted, the final trim crew moves in. They have a small pick-up truck which has boxes stocked with the trim material they need, including receptacles, switches, chimes, and a transformer, and an average of eight to 18 fixtures, plus related trim materials.

One man installs the upper work such as ceiling fixtures, wall brackets, and the panel cover; the other mechanic works on the receptacles, switches, and chimes, as well as the trim-out for a 50-amp 230-volt outlet for a range, the conventional 115-volt refrigerator outlet, and the kitchen hood.

Upon completion, the entire system is rung out with a battery-buzzer. This all takes from four to five hours per house, then the job is turned over to the FHA building inspector for approval. Material is generally ordered ahead for 50 houses at a time.

Says foreman Mr. Wingate: "Our system of wiring is emphasized from the first day a man joins a crew. Under this system, each man knows his own job, besides being thoroughly familiar with what the other man does.

Teamwork stressed

"By keeping our crews together constantly, they become experts at their operations, and a spirit is engendered which makes for a smooth-working team, which helps get each wiring job accomplished faster and more efficiently."

Mr. Wingate, an old hand at every kind of wiring, prefers men with Romex experience rather than mechanics having a background of commercial wiring experience.

While the influx of residents into Port Charlotte has been accompanied by an infiltration of industry and the resulting need for men versed in commercial wiring, Mr. Wingate feels that house wiremen are more apt to be content with its repetitive nature and thus likely to stay on the job.

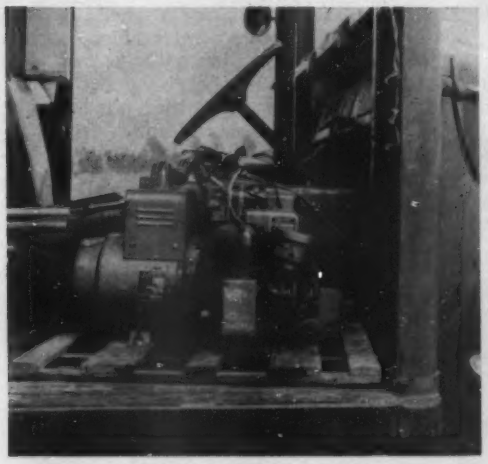
As to the firm's use of vans, Mr. Wingate says, "We'd get lost trying to work out of a pick-up truck. If the contractor's operation warrants it, he oughta' be working out of a van. A pick-up requires frequent loading and wastes men's time.

(Continued on page 120)

Foreman Gene Wingate, left, is checking supply lists with stockman.

Manager Ed Covington is attending to delay-preventing bookkeeping.

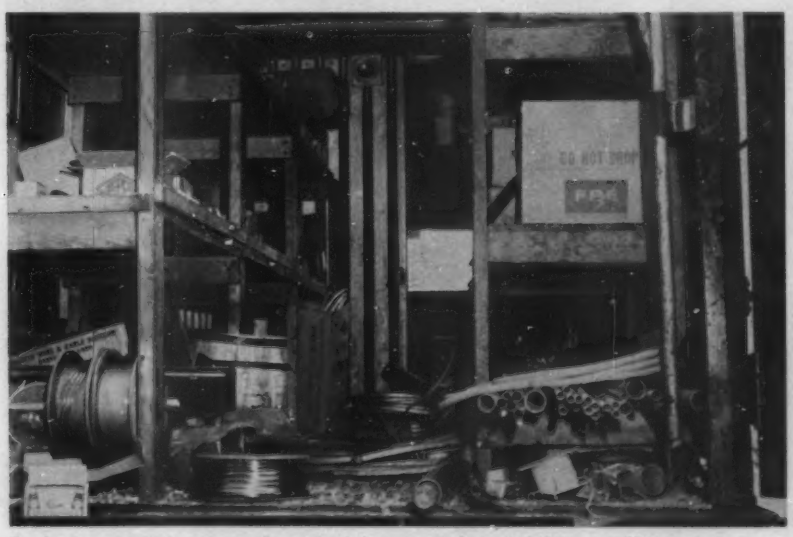
Crews work in threes, and the layout man checks each print to insure that there are no omissions.



Each van carries a gas-driven generator to operate power tools, eliminate costly waiting.

This mechanic drives about to troubleshoot.

Within minutes after the van has arrived on the project, outlets have been marked and the boxes cut in.



Each van contains enough material to rough-in 20 houses. This saves many man-hours that would otherwise be required for loading of pick-up trucks.

Profits influenced by headquarter

Home plant policies have more control over profit margins than does

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By Wendell Givens, Electrical South Field Editor, Birmingham, Ala.

◆ Profit margins are influenced greatly in the home plant rather than depending completely on job site control, believes Henry G. McClellan, veteran electrical contractor of Birmingham, Ala. He has geared his operation accordingly—and successfully.

In the physical layout of his new office and shop, in estimating, in supplying job materials and tools, in job supervision and execution, Mr. McClellan has keyed his operation to "headquarters."

"This does not in any sense minimize the importance of the actual installation," explained Mr. McClellan. "But we are convinced through long experience that proper preparation for a job usually is the make-or-break point. Even after a job is in progress, the home office is still the nerve center through close liaison with the job supervisor and the architect."

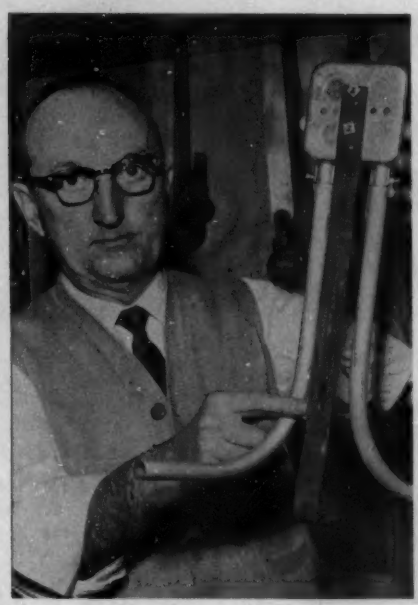
Mr. McClellan applied his thinking about "headquarters" literally from the ground up. In planning the modern plant his company moved into two years ago, he included numerous time- and laborsaving features.

A truck-level ramp has proved to be one of the most valuable of such features. The advantages are obvious: loading and unloading time cut by half, heavy equipment rolled directly on and off trucks. "It's easy to visualize benefits of the ramp when reels of wire weighing as much as 2,000 pounds are moved," said Mr. McClellan.

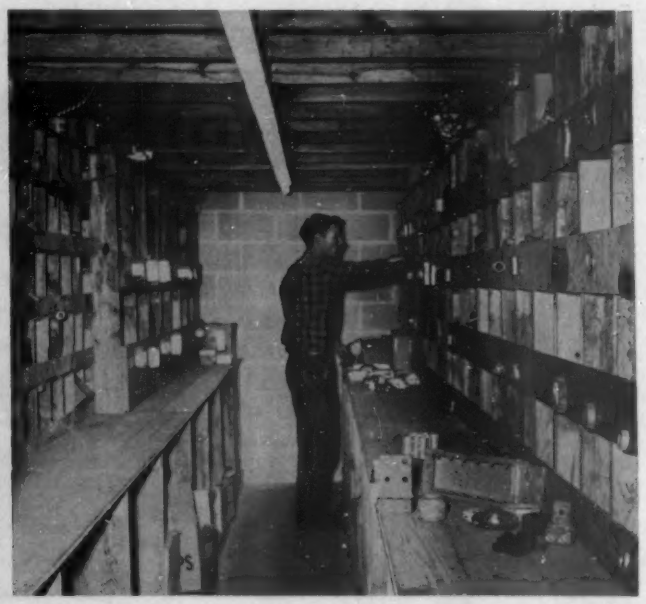
The shop includes custom designed racks for conduit and individual bins for small parts; a balcony for storage of light, bulky materials such as fixtures; adequate floor space for bending conduit, and comfortable offices. Equipment includes power cutters, hydraulic benders, power threaders, and other power tools; and roller scaffolding.

Of the scaffolding, Mr. McClellan said: "Virtually all our indoor work is done from roller scaffolding. The man aboard needs only an apprentice to hand up fixtures or other materials and he can stay up virtually all day.

"We consider the use of small and large electrical tools for both cutting and threading conduit to wire pullers a manpower fatigue



Mr. McClellan holds height spacer used to bind receptacle boxes to exact height.



Careful stocking of small parts speeds up the filling of orders and brings savings to Birmingham's McClellan Electric Co.

facilities

job site control

saver, resulting in better work and greater production per man hour."

Prefabrication of materials at the shop plays a vital role in the McClellan operation. All heavy wire, for example, is measured, cuts, and tagged before being shipped to jobs. A large storage lot at the side of the shop provides all the room necessary.

"Any contractor knows the difficulties of cutting wire on the job," said Mr. McClellan. "The area is usually cluttered and frequently there's not enough room to do the job properly. In addition, consider the handling of heavy reels of wire not cut beforehand.

"They must be loaded at the shop, unloaded at the job, and later reloaded and unloaded once again back at the shop."

Large conduit also is cut and bent at the plant with, Mc-

(Continued on page 119)

This truck-level ramp greatly helps loading and unloading at the plant, especially when 2,000-pound wire reels are handled.

A large quantity of conduit is stored in individual bins in this rack. Emphasis is placed on the prefabrication of materials at the shop.

Heavy wire is measured and cut at the McClellan plant rather than at job sites.

Flexibility designed into tall building

Aluminum interlocked cable and conduit, headerduct in the cellular floors, and a control center gutter for auxiliary functions are outstanding features

This article should be especially helpful to the following readers:

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- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

By Bob King, Electrical South Southwestern Editor, Dallas, Texas.

◆ Electrical flexibility is the keynote of the electrical installations in the new 21-story First National Bank building now under construction in Fort Worth, Texas.

Extensive use of interlocked armored cable is one of the unusual electrical features in the building. From the main switchgear located in the basement, or lower lobby, 15 of the armored cables were installed side by side with the more conventional aluminum conduit-copper cable feeder systems.

Eleven of the aluminum conduits feed from the main switchgear. Jay Hanna, general foreman for Eugene Ashe Electric Co., contractors for the electrical work on the building, said that it required only four men and about 30 minutes to run the three-conductor, 600-volt interlocked armored cable, 500 and 750 MCM, from the basement to the upper floors where they feed the 21st floor distribution panels.

All of the armored cable and conduit was supplied by the Kaiser Aluminum and Chemical Corp. A total of 7,000 feet of aluminum interlocked armor cable and 160,000 feet of conduit, ranging from ¾ inch to five inches in diameter, represents one of the larger office building installations in the country.

On the 19th floor motor control center, three large motors, two 640 hp and one 320 hp, power chillers for the air conditioning systems, exhaust fans, circulating air fans, and other such air handling units.

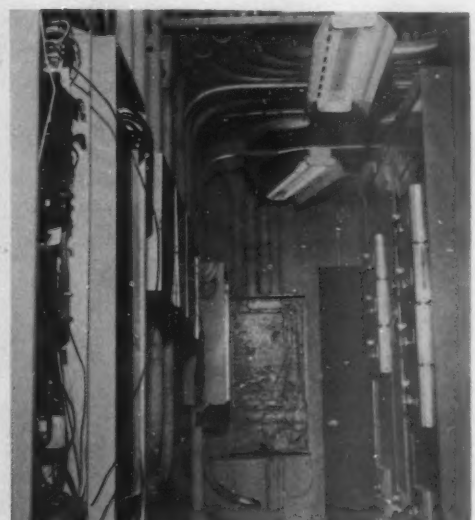
A 4,160-volt incoming feeder line from the transformer vaults installed by Texas Electric Service Company feeds through two 4,000-amp bus ducts to the main switchgear, which in turn feed to two 500-kva transformers, one in the east core, the other in the west core of the building.

The building is divided down the middle from north to south by an imaginary line, with the east side of the division termed the east core, the other side the west core.

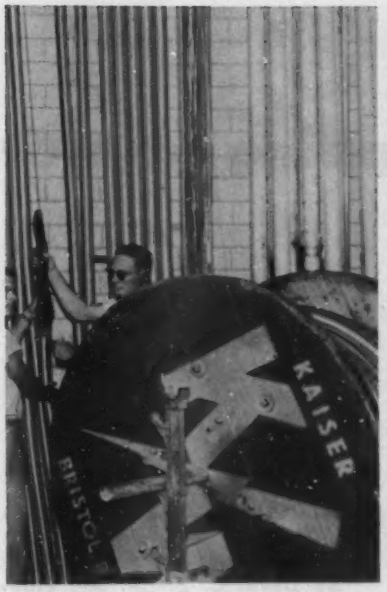
Main switchgear is located in the

(Continued on page 120)

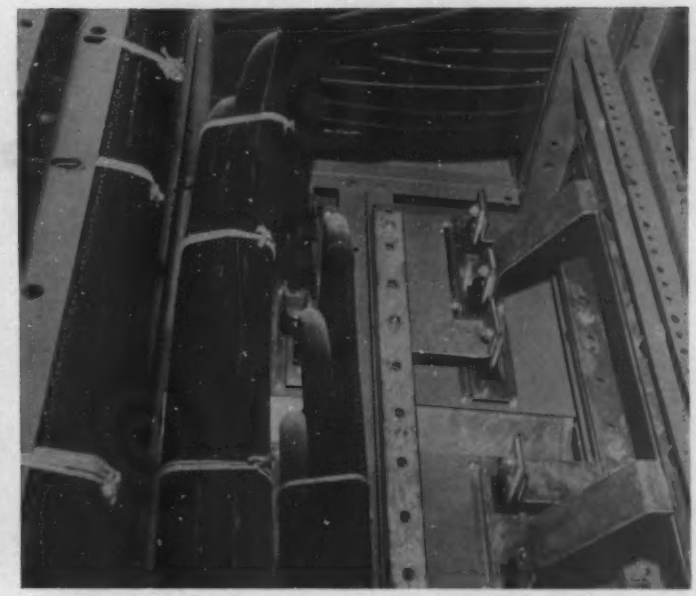
The main switchgear, which is located in the lower lobby of the new Fort Worth bank building, feeds from two 4,000-amp bus ducts.



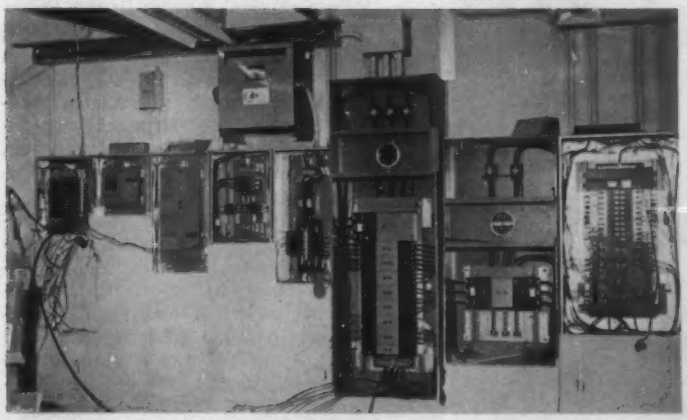
At the right is the distribution panel in the west core. At the left is the high voltage panel which feeds from a 30-kva transformer and which in turn feeds the low voltage panel for emergency lighting in that area of building.



Running interlocked armored cable to upper floors took four men 30 minutes.



Looking up into the switchgear, the 500 and 750 MCM RHW cables at the top lead to armor cable and conduit-feeder systems.



In the center is the motor control center for the air conditioning system. At far left is low voltage panel for incandescent lighting; high voltage panel at far right supplies fluorescent lighting.

The new First National Bank building is an impressive addition to Fort Worth's skyline.

Before the concrete on the cellular flooring is poured, the wire mesh can be seen covering the headerduct, except for access units.

Timesavers speed shopping center

Practical procedures help to meet immediate problems arising on project

This article should be especially helpful to the following readers:
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- Electrical Utilities ✓
- Electrical Wholesalers ✓
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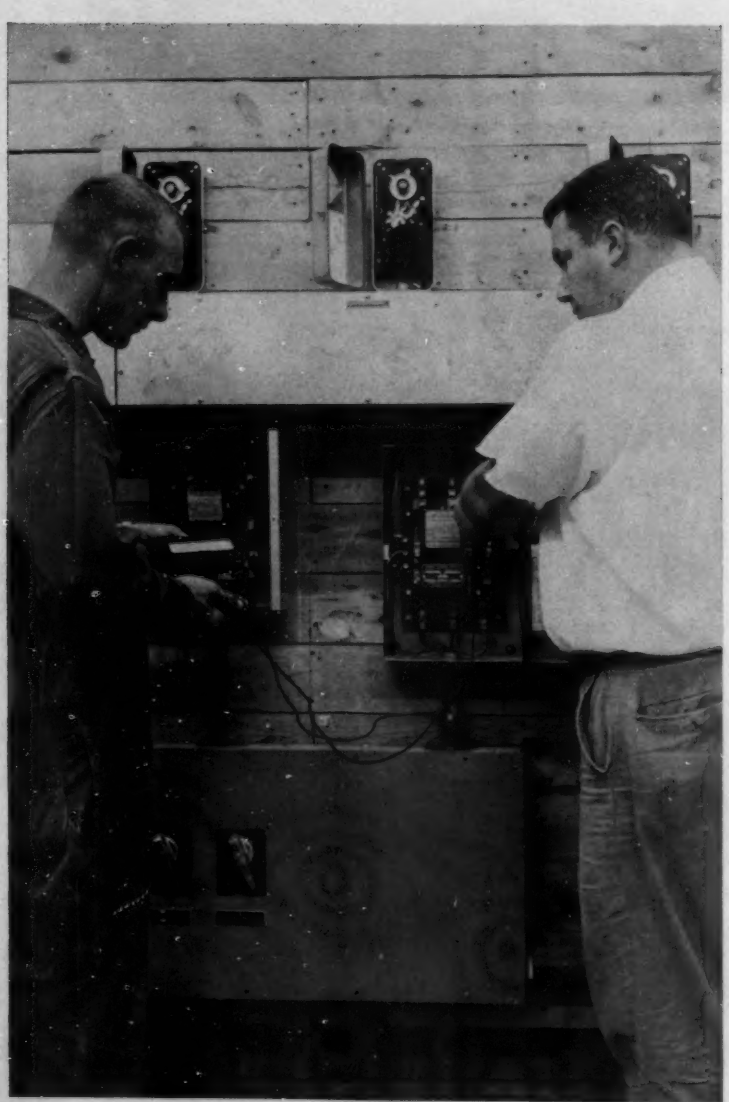

Electrician Dick Griffin, left, and David C. Smith, job foreman, check voltage on an ohmmeter tester at the parking lot and canopy lighting of the project shop at the Penn-Mar Shopping Center, in Maryland.

By David C. Smith, Job Foreman, B and D Electric Co., Mt. Rainier, Md.

◆ In our installation of the entire electrical system in the Penn-Mar Shopping Center, Forestville, Md., comprising 33 stores and a parking lot for 3,200 cars, we employed a number of practical procedures designed to meet immediate problems arising on the job, and efficient methods were employed to save time and labor.

In the food center, where limited space precluded use of standard equipment for the main service, we had custom-made the component switches and main distribution panel. All supports and racks to mount the equipment, as well as troffers, were custom-made. This was a 2,000-amp service with two mainline switches, one 800-amp and the other 200-amp.

At the variety shop we preconstructed the mounting frame of the ceiling lighting fixture. Using ¾-inch multi-frame and ⅜-inch rods, we prefabricated this mounting frame and fastened it to channel iron to give positive alignment to the fixture after the plastering. If this had not been done, considerable time would have been consumed adjusting the fixtures to proper alignment.

Centralized switches

In our project shop we concentrated all light switches, making a compact and neat installation. All light switches work out of this area. To facilitate matters we had embossed tapes on each panel indicating breaker trough, canopy lighting panel, etc. We

electric job

found the tapes neater, quicker, and far more economical than painting or stenciling.

Lighting at the bank proved pleasing both to patrons and working personnel, whose needs we tried to meet. Three types of lighting were combined here. Over the tellers' cages we installed a luminous ceiling. Square fixtures recessed in the ceiling tied in well with the decor in the customers' area. Continuous running streamline fluorescent fixtures placed over the offices of administrators provided satisfying illumination, attracting attention to this rear area where patrons may want special services.

In affecting timesavings in a job that might otherwise have taken

(Continued on page 119)

Mr. Griffin makes final adjustments on time clock and contactors in the project shop, where the shopping center's lights are concentrated. Embossed tapes on each panel indicate the area that is lighted.

A preconstructed mounting frame gives positive alignment to the fluorescent fixture after the plastering has been done.

Combined lighting of three types is used in the center's bank. Luminous ceiling at right serves the tellers' area, with streamlined light over the officers' area and recessed squares in the customers' area.

Conference stresses school lighting

IES regional meeting hears importance of good illumination in classrooms

This article should be especially helpful to the following readers:

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H. G. "Casey" Jones, representing the North Texas section, is accepting the Reuben Lothrap Travel Award trophy from J. B. Deck, Jr., vice-chairman of the Southwestern Region. This is the second year in succession that the Lothrap trophy has been won by the group. Seated alongside the speakers' rostrum is Richard G. Slauer, national president.

By Bob King, Electrical South Southwestern Editor, Dallas, Texas.

◆ The recent Southwestern Regional Conference of the Illuminating Engineering Society brought nearly 150 members, visitors, and guests to Oklahoma City to hear industry officials speak on lighting problems and new techniques, particularly in the field of classroom lighting.

Official headquarters was at the Skirvin Hotel. First day of the three-day conference was taken up with registrations and a regional activities meeting that afternoon. A reception honoring Richard G. Slauer of Wheeling, W. Va., national president of the IES, was held that evening in the hotel.

Busses and cars transported groups from the hotel to the University of Oklahoma campus at Norman the following morning, where school officials and lighting specialists studied various aspects of school lighting.

Welcoming the IES members to the campus and presiding over the meetings was J. D. Palmer, assistant professor of electrical engineering at the University, who also introduced Wilbur Riddle, resident architect for General Electric at Nela Park, Cleveland, Ohio, as first speaker on the program.

Mr. Riddle voiced the opinion that lighting must be suited for people, and not to try to suit the people to the lighting as is sometimes supposed. He also gave a background on the importance of light, pointing out that illumination has much to do with the moods and attitudes of students in their classroom work.

Also appearing on the program from General Electric's Nela Park offices in Cleveland was Robert T. Dorsey, who said that an entire new environment should be considered in the area in which a child is studying.

Said Mr. Dorsey, "Walls, ceilings, floors, desk tops, in addition to the lighting fixtures and other components, are to be taken into consideration to reduce contrast and provide adequate illumination for comfortable lighting."

Speaking on classroom lighting in relation to learning ability, Ted Sargent of Sylvania Electric Products, Salem, Mass., said that from actual experiments it was found that fifth grade students showed a very impressive upward curve in learning ability when their classroom lighting was increased from about six footcandles to 30 footcandles.

He said also that further experiments are underway to find what the results will be when illumination is upped from 30 to 70 footcandles, although it is believed that the results will not be as impressive as in the first experiment. He is of the opinion that all classroom lighting should have a minimum of about 50 footcandles for adequate illumination.

R. D. Bradley, Day-Brite Lighting Corp., who spoke on, "School Lighting Design for Areas Other Than Classrooms," brought out a number of facts to support his contention that school design, time spent in the school, and other

(Continued on page 118)

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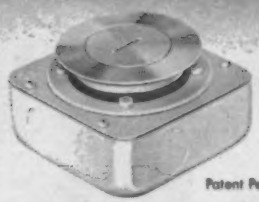

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Electrical testing and maintenance firm uses mobile unit

By W. U. McCoy, Electrical South Field Editor, Oklahoma City, Okla.

◆ Contractor W. A. Stout, owner of Southwestern Electric Co., Oklahoma City, and his manager-estimator, H. J. Hamilton, have designed special equipment and joined forces to form a new electrical enterprise which has gotten off to a fast start in Oklahoma.

The new enterprise is Electrical Testing and Maintenance Corp., 107 N. E. 23, Oklahoma City, which checks, tests, calibrates, and repairs electric watthour meters, current transformers, potential coils, and allied equipment, either in its laboratories or in a completely outfitted mobile unit in the field, for municipalities, REA's, or individuals.

The mobile unit is completely heated and air conditioned electrically. Hydraulic jacks can support truck.

Technician L. J. Burchell is testing and calibrating a meter in the unit.

Checking, calibrating, and repairing meters makes up the bulk of work for the firm, and Mr. Stout says, "The equipment and service has met with great favor by the cities and REA's who have used it.

"It means increased revenue when slow meters are corrected, and that increased revenue more than pays the nominal charge for calibration."

The new firm was formed in November last year, and already many cities in the state are clients.

Complete service can be performed in the field with about $7,500 worth of equipment in the $10,000 mobile unit, plus a complete set of parts for about 90 per cent of the applications.

Mr. Stout and Mr. Hamilton designed the mobile unit and built the special equipment inside.

The unit is completely heated and air conditioned electrically, summer and winter. It has electrically heated floor mats, plus five kw of electric heat, and two tons of air conditioning. The operator can thus work at maximum efficiency, and with the temperature kept constant and air filtered, the equipment operates at peak efficiency.

The truck is equipped with hydraulic jacks so the weight of the truck can be removed from the springs and kept solid, constant, and level, without vibration, for completely accurate testing.

Equipment includes an air compressor, photoelectric cells, transformers, solvents, testing devices, tools, and a stock of parts for almost all requirements. A technician takes the mobile unit into the field, and works in the lab when he is not out in the unit.

The new firm was formed when O. F. Tolley of Oklahoma City retired in October 1960. He had been doing this type of work on a small scale for 16 years. Mr. Stout and Mr. Hamilton bought Mr. Tolley out and decided to develop the business on a much larger scale.

Mr. Stout says the firm has found the demand so great and the business increase so strong in so short a time that they are planning to put five of the mobile units in the field. He points out there are several hundred thousand meters in the state which should be calibrated periodically.

Plans are also under way to expand operations to relays, carrier control equipment, supervisory control equipment, oil, and telemetering.

Fluorescent paint sprayed on tools aids identification

By Bob King, Electrical South Southwestern Editor, Dallas, Texas.

◆ The use of fluorescent spray paint has proved to be an excellent method of identifying tools and equipment, plus being a good safety measure for employees of McClure Electric Co., Dallas, Texas.

Clarence Melton, service manager for the electrical contracting firm, who first had the idea of using the brilliant paint in this way, said they started applying it to toolboxes, oil cans, and other equipment on jobs to make easier and quicker identification.

"On a large job," he explains, "you have electricians, plumbers, carpenters, air-conditioning and telephone men, and many others with their toolboxes and other equipment all scattered about. We find painting our equipment with this type paint the best method of keeping track of it."

The bright fluorescent paint is known commercially as Day-Glo, Glo-Brite, and other trade names, and can be seen for exceptionally long distances.

McClure Electric also stencils the company name with the paint on the signs that they hang on their jobs, usually on the foreman's shack, and on their aluminum scaffolds.

Although they haven't as yet done any work calling for the use of steel safety helmets, Mr. Melton insists that when they do they will borrow the idea from Dallas Power and Light Company and have their men wear helmets painted with the fluorescent paint as DP&L's servicemen do.

As a further safety measure, the back of each company service truck has also been sprayed with the bright, glowing red paint.

In addition to using the paint for safety and identification, they have found that losses from stealing have been cut down considerably, since anyone attempting to steal a toolbox or other equipment usually thinks twice when the item can be seen for such long distances.

Clarence Melton, service manager for McClure Electric, is checking a sign he has sprayed with the fluorescent paint. The firm's losses from stealing have been reduced by the use of the bright paint.

Strong sales presentation backs bid

By Harry J. Miller, Electrical South Field Editor, Sarasota, Fla.

◆ When Montgomery-Roberts, a leading department store in Bradenton, Fla., embarked on a major expansion of its buildings, the owners expressed the desire for a modern luminous ceiling lighting job.

Bradenton electrical contractor James R. Ward, who wired the new addition, submitted his realistic bid for the lighting, and it seemed acceptable. But it has been said that there isn't much that cannot be lowered in quality and sold for less in any line of endeavor, and the electrical industry is no exception.

As a consequence, Montgomery-Roberts was solicited with a fixture installation "just as good and a whole lot cheaper."

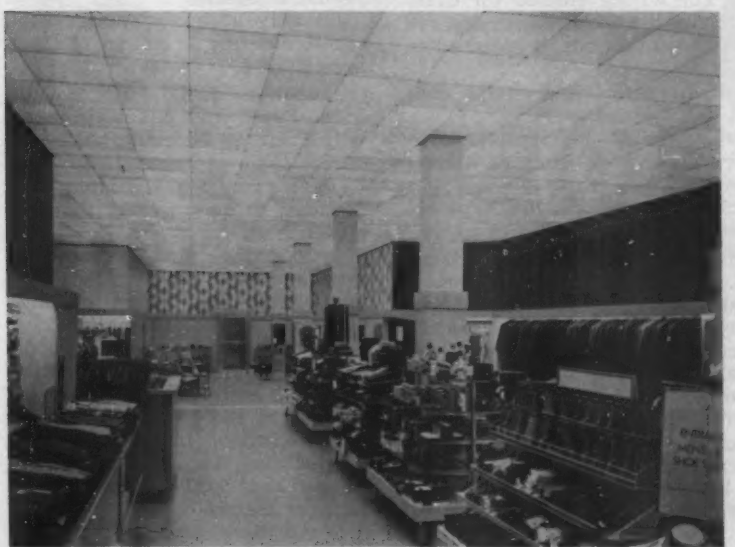
In Mr. Ward's opinion it was neither. To insure landing the contract, a ceiling was submitted which had two captivating sales points.

Unlike "just as good" louver panels, it was pointed out that in case of a fire, the "just as good" plastic had a tendency to smolder. It also gave off volumes of black smoke whose pungent fumes sank deep into the clothing the store was to handle. Mr. Ward's panels would not support combustion.

It was pointed out that the new ceiling Mr. Ward offered, by Columbia, because of its unique method of hanging and support furnished by tiny crowfeet at the corner intersection of panels, produced an installation in which no supporting rail or tracks could be seen from below.

These two sales arguments clinched the deal, and the store ordered the ceiling, " . . . even though it cost the owners about 25 per cent more," said Mr. Ward.

By emphasizing quality, Mr. Ward got the job.



A good sales presentation emphasizing the quality of the installation enabled the contractor to give the store this attractive luminous ceiling. Tiny crowfeet are the only visible supports for the plastic panels.

Application of Code requirements

Class II installations in hazardous locations require using equipment which is dust-ignition-proof and which operates at safe temperatures

By Walter R. Stone, Contributing Editor on Code Rules, Utica, N. Y.

◆ Continuing with the discussion of the Code requirements for hazardous locations, we begin in this issue with the requirements of Article 502 governing Class II installations.

The rather awkward term "dust-ignition-proof" is referred to from time to time in Article 502, having largely replaced the terms "dustproof" and "dust-tight" which formerly were used to denote equipment suitable for use in locations considered hazardous by reason of the presence of dust.

Section 502-1 defines "dust-ignition-proof" as being ". . . enclosed in a manner which will exclude ignitible amounts of dusts or amounts which might affect performance or rating and which, when installation and protection are in conformance with this Code, will not permit arcs, sparks or heat otherwise generated or liberated inside of the enclosure, to cause ignition of exterior accumulations or atmospheric suspensions of a specified dust on or in the vicinity of the enclosure."

Briefly, then, such equipment must do three things: (1) it must not permit the escape of arcs, sparks, or hot particles; (2) it must not permit the entrance of dust in amounts which would be ignitible or which would affect its performance or temperature rating; and (3) it must be capable of dissipating heat rapidly enough so that, even when operating in dense atmospheres and therefore likely

---

Code test questions

1. The term "dust-ignition-proof" refers to an explosion-proof enclosure which is suitable for both Class I and Class II locations. True or false?

2. Dust which is carbonized is susceptible to spontaneous ignition. True or false?

3. Transformers containing oil which will burn, when installed in a Class II location, are required to be installed in a vault which has, among other things, doors which are provided with seals, such as weather stripping. True or false?

4. Transformers and capacitors may be installed in areas containing dust from magnesium, aluminum, or aluminum bronze powders provided that such transformers and capacitors, together with their terminal connections, are approved as complete assemblies for Class II locations. True or false?

5. Where high-voltage surge protection is required to be provided for a wiring system in a Class II location in geographical areas where lightning is prevalent, such protection shall include interconnection of all grounds. True or false?

6. The wiring method for Class II, Division 1 locations, except for flexible connections, is required to be:

(a) threaded rigid metal conduit only.

(b) threaded rigid metal conduit or type MI cable.

(c) rigid metal conduit, type MI cable, or EMT.

Which is correct? a? b? or c?

7. The wiring method for Class II, Division 2 locations, except for flexible connections, is required to be:

(a) threaded rigid metal conduit only.

(b) threaded rigid metal conduit or open conductors on insulators.

(c) rigid metal conduit, type MI cable, or EMT.

Which is correct? a? b? or c?

8. In Class II, Divisions 1 and 2 locations where flexible connections are necessary and electrically conducting dusts are present:

(a) flexible metal conduit may be used.

(b) flexible metal conduit shall be used.

(c) flexible metal conduit shall not be used.

Which is correct? a? b? or c?

9. Sealing is required in Class II locations:

(a) only where a raceway provides communication between an enclosure which is required to be dust-ignition-proof and one which is not.

(b) in all raceways entering or leaving the hazardous area, at all enclosures containing arcing devices, and in all raceways two inches in size or larger entering a junction box containing taps, joints, or splices.

(c) only at arcing devices and where entering or leaving the hazardous area.

Which is correct? a? b? or c?

10. Fuses and circuit breakers which are intended to interrupt current and which are installed in Class II, Division 1 locations are required to be provided with enclosures:

(a) of the dust-ignition-proof type approved, together with the enclosed devices, as an assembly for Class II locations.

(b) of the tight metal type designed to minimize the entrance of dust with tight-fitting or telescoping covers and free from holes or other openings from which arcs, sparks, or hot particles could escape and ignite adjacent combustible material.

(c) of the explosion-proof type.

Which is correct? a? b? or c?

Correct answers will be found at end of article on page 117.

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packs more light in less space than any other filament lamp

Listen to the nearsighted Mister Magoo . . . "1959? Seems like last week! I volunteered but the authorities picked seven other Astronauts—and General Electric invented the Quartzline lamp. Happy birthday, Quartzline. Tarnation! This confounded pen won't write!"

Understandable mistake, Mister Magoo. The 5-inch, 500-watt Quartzline *is* no bigger than a pen. But it's 19% more efficient than a regular lamp, never grows dim, and provides better light control than any earlier lamp.

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For more details on above items, use reply card on page 19

to be covered with dust, it will operate at a safe temperature.

The need for a capability of operating at a safe temperature when covered with dust is further emphasized in the fine print note following Section 502-1 which states, "Equipment installed in Class II locations should be able to function at full rating without developing surface temperatures high enough to cause excessive dehydration or gradual carbonization of any organic dust deposits that may occur.

"Dust which is carbonized or is excessively dry is highly susceptible to spontaneous ignition. In general, maximum surface temperatures under actual operating conditions should not exceed 165 C (329 F) for equipment which is not subject to overloading, and 120 C (248 F) for equipment such as motors, power transformers, etc., which may be overloaded."

The second paragraph of the fine print note brings out a very important fact which is often not understood even by some inspectors. To quote: "Equipment and wiring of the type defined in Article 100 as explosion-proof is not required in Class II locations, and may not be acceptable unless approved for such locations."

Some of those who know that explosion-proof equipment is not required in Class II locations are nonetheless surprised to learn that it is not always acceptable when it is so used.

The reason for this is because equipment which is explosion-proof, unless also designed and approved for Class II locations, may run excessively hot in atmospheres containing dust, bringing about the very condition which is pointed out as being hazardous in the above quoted fine print note.

It should be remembered that in this department in an earlier issue, attention was called to Section 500-2 which, among other things, states, ". . . it is necessary therefore that equipment be approved not only for the class of location but also for the specific gas, vapor or dust that will be present."

Dust-ignition-proof enclosures which are required in some dust locations are superior to some other types of enclosures which are permitted in other dust locations and which are required only to be tight-fitting, designed to minimize the entrance of dust, be without holes or other openings, and be provided with tight-fitting or telescoping covers.

Where the latter type meets the minimum requirements, the superior, dust-ignition-proof type would also be permitted, of course.

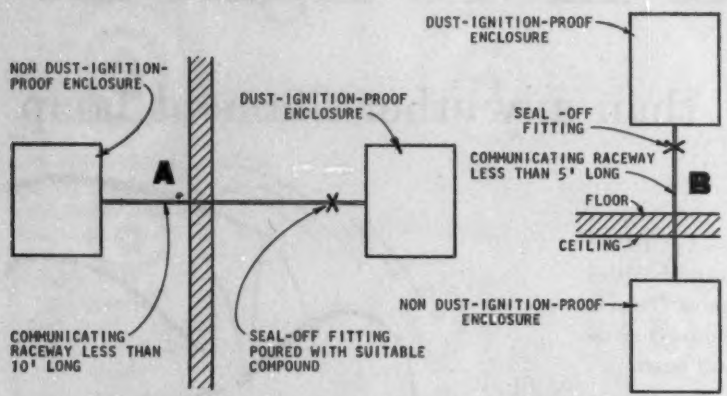

Fig. 1—One method of sealing in Class II locations is by the use of a fitting designed for the purpose. This method is usually used when the minimum lengths of horizontal or vertical raceway seals cannot be obtained. At "A" is a situation involving a communicating raceway less than ten feet long, and at "B" is one which is less than five feet long.

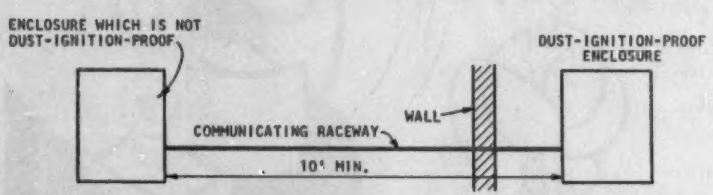

Fig. 2—A horizontal section of raceway not less than ten feet in length constitutes a suitable seal. Here the raceway travels from enclosure which is not dust-ignition-proof to enclosure which is ignition-proof.

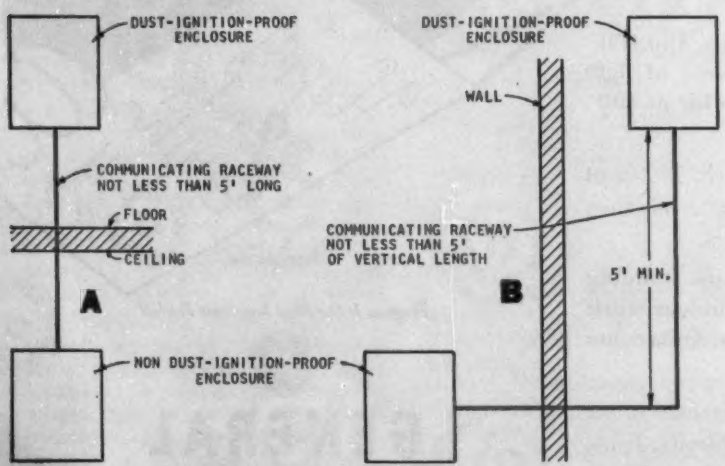

Fig. 3—A vertical length of raceway between enclosures which is not less than five feet long will be a suitable seal for Class II locations.

Three classifications

Transformers and capacitors are divided into three classifications by Paragraph (a) of Section 502-2 for Class II, Division 1 locations with special rules for each classification as follows:

(1) Transformers and capacitors which contain a liquid that will burn are required to be installed in a transformer vault meeting the provisions of Part C of Article 450 with the further provisions that any door or other opening communicating with the hazardous area be equipped with self-closing fire doors on both sides of the vault wall.

Such openings are required to be

snugly fitted and provided with seals, such as weather stripping, to minimize the entrance of dust into the vault.

Ducts and vent openings are required to open only to outside air. Pressure-relief valves are required to be provided, and such pressure-relief devices are required also to exhaust only to the outside air.

(2) Transformers and capacitors which do not contain a liquid that will burn are required to be installed in transformer vaults meeting the requirements of Part C of Article 450 or else be approved as a complete assembly for Class II locations. Such approval must include all terminal connections.

(3) Transformers and capacitors are not permitted to be installed in areas containing dust from magnesium, aluminum, aluminum bronze powders, or any other metal of similar hazardous characteristics. Such dusts are both electrically conductive and highly explosive.

Division 2 installations

Similar to Paragraph (a) for Class II, Division 1 locations, Paragraph (b) of Section 502-2 has three classifications for transformers and capacitors when installed in Class II, Division 2 locations:

(1) Transformers and capacitors containing a liquid that will burn are required to be installed in transformer vaults complying with the provisions of Part C of Article 450.

(2) Transformers containing Askarel and which exceed 25 kva capacity are required to be provided with pressure relief vents. Such vents are required to be connected to a flue leading outside of the building unless provisions are made for absorbing any gases which may be generated by arcing inside of the case. A six-inch or greater air space is required to be provided between the case and any adjacent combustible material.

(3) Dry type transformers are required to be installed in vaults unless all windings and terminal connections are enclosed in tight metal housings without ventilating or other openings and the potential does not exceed 600 volts.

High-voltage surge protection for Divisions 1 and 2 of Class II locations is required by Section 502-3 for systems supplied from overhead distribution systems in geographical areas where lightning is prevalent.

Such protection is required to include ". . . suitable lightning protective devices, interconnection of all grounds, and surge-protective capacitors." Protective devices, designed for the purpose, should be installed in each ungrounded, overhead conductor.

In Class II, Division 1 locations, Section 502-4(a) requires that the wiring method be threaded rigid metal conduit or type MI cable with terminal fittings approved for the location.

Where flexible connections are necessary, dust-tight flexible connectors, flexible metal conduit with approved fittings, or flexible cord approved for extra-hard usage and provided with bushed fittings are required to be used.

Where dusts are of the electrically conducting type, flexible cords are required to be equipped with dust-tight seals at both ends, and flexible metal conduit is not permitted to be used at all.

Where flexible cords are used, an additional grounding conductor is required unless other acceptable means of grounding are provided.

(The extra grounding conductor

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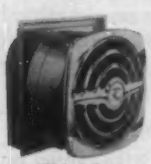

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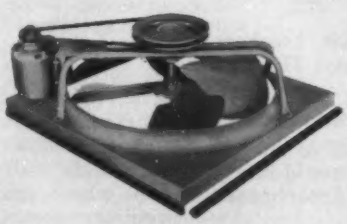

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within the same covering as the circuit and neutral conductors is highly recommended and offers the best solution to the grounding problem. Some inspectors will not accept a grounding conductor which has been run separately from and independently of the circuit conductors in such cases.)

Conductors for flexible connections, like other wiring, are required to have insulation suitable for the conditions of use, such as where subject to oil or corrosive influences, unless enclosed in a suitable sheath such as a lead or nylon jacket.

Fittings and boxes are required to have threaded hubs and close fitting covers. Holes or other openings through which dust might enter or through which arcs, sparks, or hot particles might escape are prohibited. Mounting holes are required to be on appendages, or "feet" outside of the box.

Fittings and boxes are required to be of the dust-ignition-proof type and approved for Class II locations if they contain taps, terminals, or splices, or if they are used in locations containing dusts of an electrically conducting nature.

Wiring method specified

Paragraph (b) of Section 502-4 requires that the wiring method in Class II, Division 2 locations be rigid metal conduit, electrical metallic tubing, or type MI cable with terminal fittings approved for the purpose.

Note that in Division 2, the rigid metal conduit is not required to be threaded. Threadless connectors are therefore permitted in Division 2 locations. Flexible connections must comply with the same requirements as flexible connections in Class II, Division 1 locations.

Fittings and boxes in which taps, splices, or terminal connections are made are required to be so designed as to minimize the entrance of dust. They are required to have telescoping or close fitting covers to prevent the escape of arcs, sparks, or hot particles and be free from holes or other openings through which such sparks or hot particles could escape and ignite combustible material. Holes for mounting are required to be on appendages outside of the box.

The sealing requirements for Divisions 1 and 2 of Class II locations are listed in Section 502-5 and are strikingly different from those of Class I locations.

The only requirement for sealing in Class II locations is in a raceway which provides communication between an enclosure which is required to be dust-ignition-proof and another enclosure which is not required to be dust-ignition-proof.

The required sealing can be accomplished in three ways: (1) by a permanent and effective seal, such as by the use of a sealing fitting poured with suitable sealing compound, see Figure 1; (2) a horizontal section in the raceway not less than ten feet in length, see Figure 2; or (3) a vertical section in the raceway extending downward from the dust-ignition-proof enclosure a distance of not less than five feet, see Figure 3.

Requirements for switches, circuit breakers, motor controllers, and fuses are divided into three categories by Paragraph (a) of Section 502-6 as follows:

(1) Such devices which are normally used to interrupt current, including pushbuttons and relays; or which are installed where electrically-conducting dusts are present, such as coke dusts, are required to be provided with dust-ignition-proof enclosures.

Such enclosures, together with the enclosed equipment in each such case, are required to be approved as complete assemblies for Class II locations.

(2) Isolating type switches which do not have fuses and which are not to be used for interrupting current and which are not in areas containing electrically conducting dusts are required to be enclosed in tight metal enclosures designed to minimize the entrance of dust.

Such enclosures are required to have snug-fitting or telescoping covers and be free from holes or other openings from which arcs, sparks, or hot particles could escape and ignite combustible material. Holes for mounting are required to be on appendages outside of the enclosure.

(3) Switches, circuit breakers,

(Continued on page 117)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Does SE cable require mechanical protection?

QUESTION: We would like for you to clarify an interpretation of Paragraphs 338-3 and 338-4. Our question is: Would SE cable run along the outside wall or along the building finish be required to have mechanical protection if it is fastened securely to the wall?

ANSWER: Type SE cable would not require mechanical protection unless the wall surface to which it was attached was so situated that physical damage to the cable might be expected.

An outside wall which was bordered by an adjacent driveway without a curb between the edge of the driveway and the wall would come within this category; and a cable mounted on such a wall should be protected from physical damage by a raceway or by suitable guard strips.

A driveway which is separated from a wall by a distance of four or more feet would not likely be considered by an inspector as being adjacent to the wall.

Some inspectors would not require protection where the distance between the edge of the driveway and the wall was as much as three feet. But the local inspection authority should be consulted for distances of less than four feet. (There is no specified distance in the Code for this separation.)

Section 230-46, in the last sentence, states, "Service-entrance cables, where liable to contact with awnings, shutters, swinging signs, installed in exposed places in driveways, near coal chutes or otherwise exposed to physical damage, shall be of the protected type or be protected by conduit, electrical metallic tubing or other approved means." (Type SE, as distinct from type ASE, is not of the protected type.)

Cables mounted on walls alongside of flower beds, swings, and similar locations should also be protected in the areas where they would be subject to damage. As stated in Section 338-1(b), type SE cable is " . . . not required to have inherent protection against mechanical abuse."

Such protection must therefore be provided by the contractor when installed if needed. *On most dwellings*, however, mechanical abuse to cables securely fastened to outside walls is not likely except where subject to damage by vehicles passing along adjacent driveways.

In connection with your question, I would like to mention for good measure that type SE cable is permitted to be used for branch circuits only where it has insulation on the neutral conductor equal to that on the ungrounded conductors, except for branch cir-

cuits supplying ranges, wall-mounted ovens, counter-mounted cooking units, and clothes dryers, or for branch circuits where the uninsulated conductor is used for equipment grounding purposes only.

In addition, where type SE cable, under approved conditions, is used for branch circuit wiring, it must comply with the requirements of Article 336 which, among other things, requires strapping every 4½ feet.

Your question mentions the use of the cable for branch circuits on outside walls. This location would still be governed by the Code rules for interior wiring. Section 338-3 restricts the use of the cable when " . . . used in interior wiring systems . . . . " That part of the cable which was secured to the outside walls, although actually outside of the building, would nevertheless be a part of the interior wiring system.

Therefore, you are cautioned not to use type SE cable without an insulated neutral for branch circuit wiring, other than for ranges, dryers, etc., as mentioned above, even when installed on outside walls.

May two circuits be put in box at gas pump base?

QUESTION: Does Section 514-5 prohibit the installation of a 120-volt lighting circuit and a 240-volt power circuit in the same junction box in the base of a gasoline pump?

ANSWER: This section states, "Each circuit leading to or through a dispensing pump or island shall be provided with a switch or other acceptable means to disconnect simultaneously from the source of supply all conductors of the circuit including the grounded neutral, if any."

The purpose of requiring a disconnecting switch to open all conductors, including the grounded neutral conductor, of a circuit leading to or through a gasoline dispensing island is to guard against arcing at the island while repairs are being made even though the neutral and a phase wire may have been inadvertently reversed.

Therefore, any combination of circuits in the same junction box or other enclosure at the same pump or on the same island which could be inadvertently exchanged or which could be so connected that some of the conductors were energized after one disconnecting switch supplying conductors to this box or enclosure had been opened would, in my opinion, be in violation of the intent of Section 514-5.

Usually, one circuit to each pump is sufficient for both the motor and the light. Any pump requiring more than one circuit should be called to the attention of the inspection authority having jurisdiction, who should withhold approval until and unless it could be substantiated that no accident would result from the use of extra circuits in the enclosure.

The difference in voltages would not enter into the question unless one of the circuits exceeded 600 volts. This opinion, therefore, is based on the special intent of the provisions of Section 514-5 and not on the provisions of Section 300-3, which would not prohibit the two circuits in the same box or in the same raceway.

Section 514-5 is amendatory of and supplementary to Section 300-3 as applied to gasoline pumps and therefore prevails under the special conditions described.

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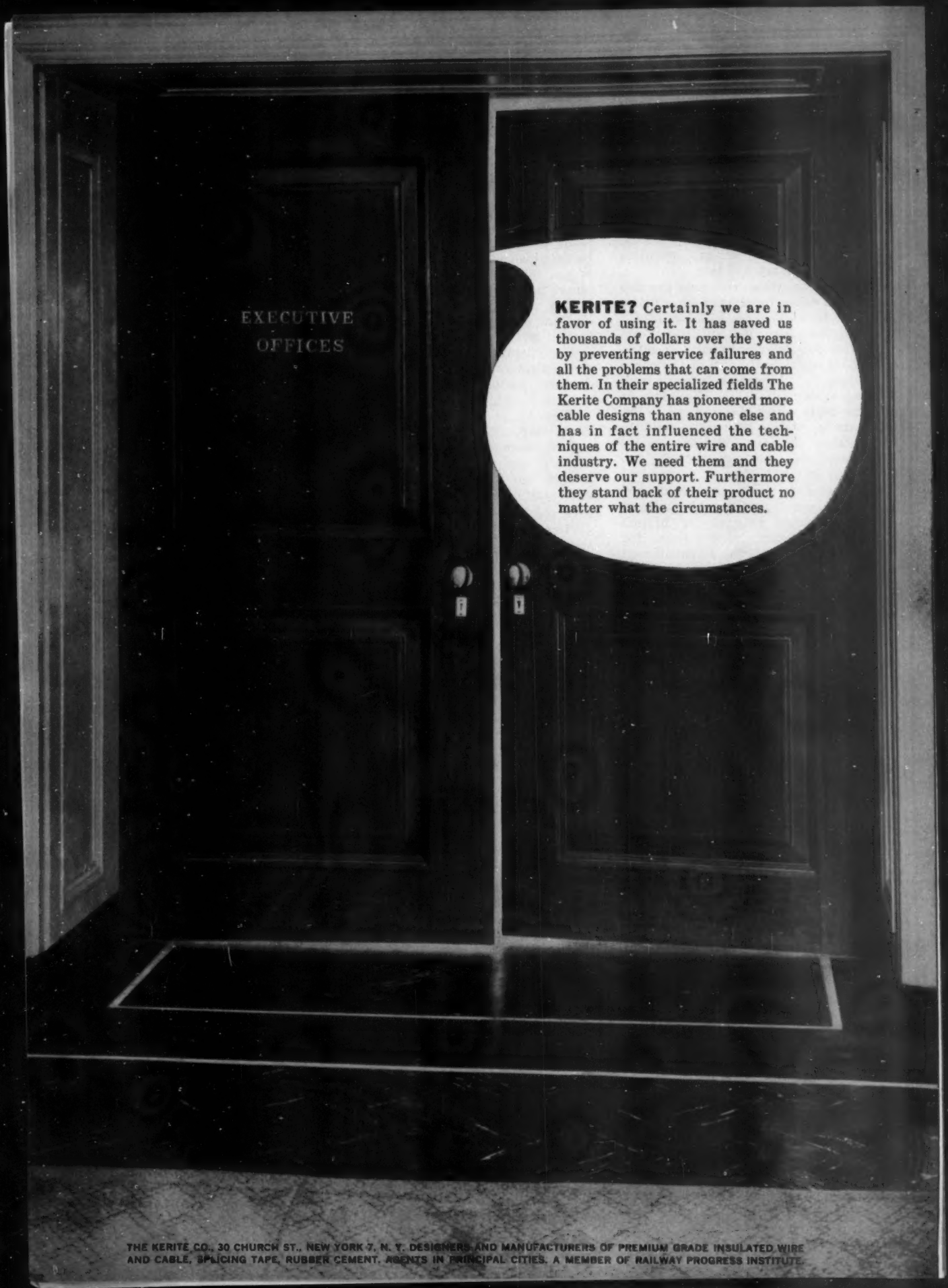
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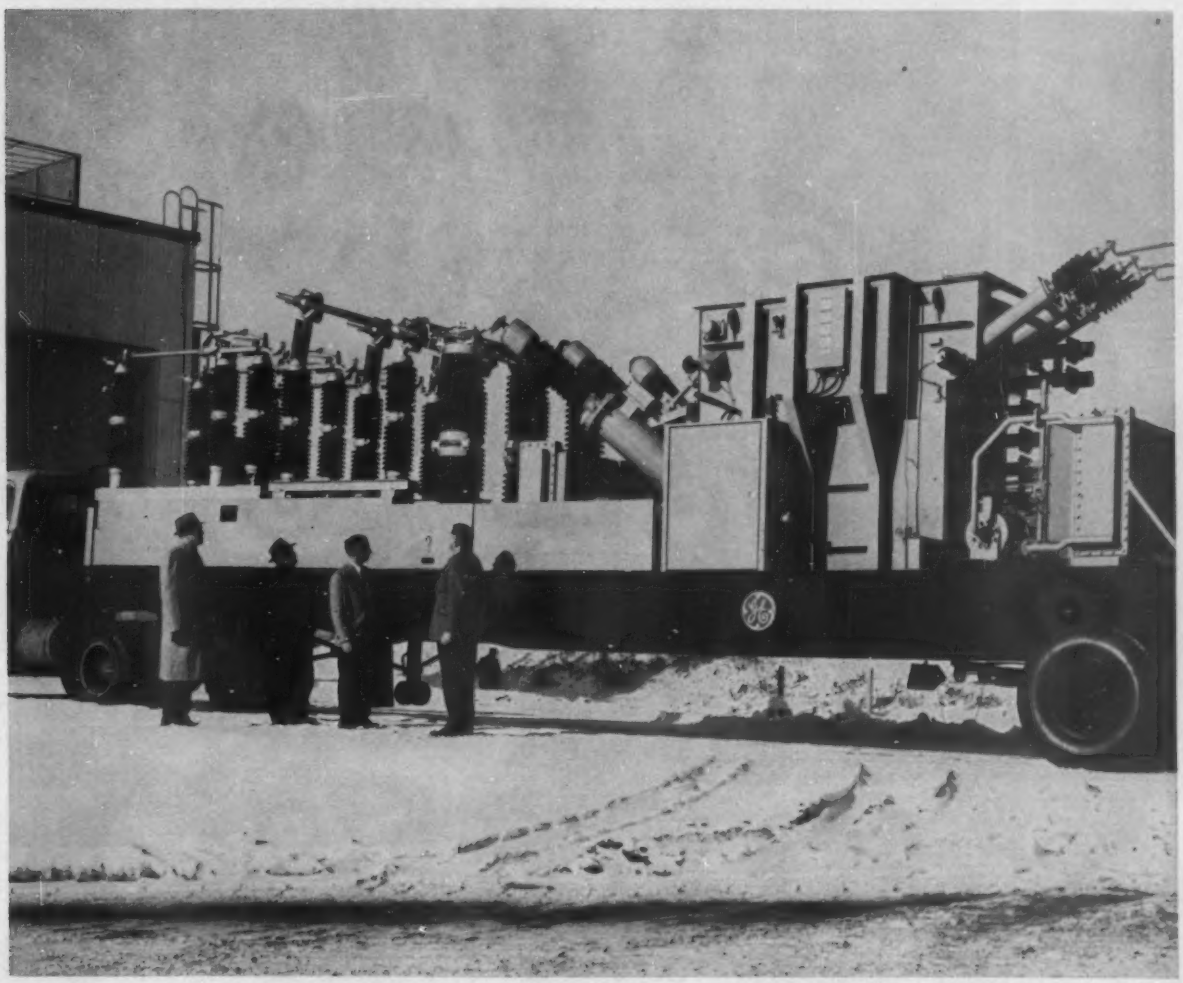
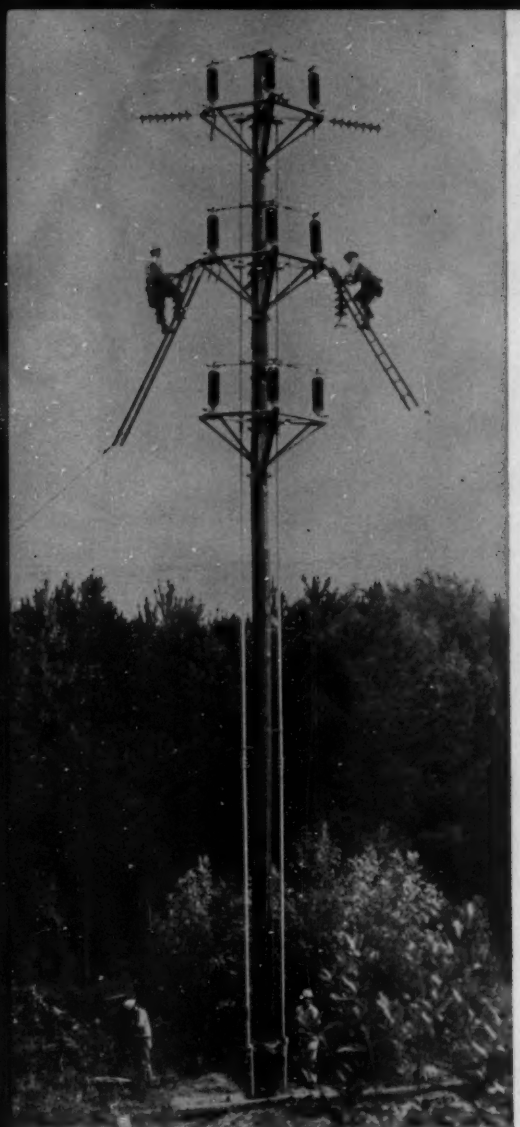


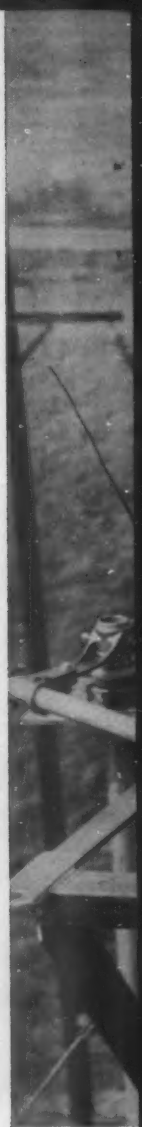
Fifteen-kv substation added to Virginia Electric and Power's mobile equipment—page 80

Loading of distribution transformers—page 66
New capacitor control senses current and voltage—page 70
Southern plant to use aluminum transmission towers—page 72
Characteristics of substation loads—page 74
Homes have inadequate service entrances—page 82
Meeting covers all facets of poles—page 90



MINIMUM CREW TIME is needed to install Southern States Pole-Pak Air Switches. One pole is all that's needed for three-way switching, compared with conventional arrangements requiring up to six poles. Limited land requirements offer opportunities for installations where other types are not possible. Savings can be substantial.

EXCLUSIVE MOUNTING SYSTEM SPEEDS ERECTION OF SOUTHERN STATES' POLE-PAK



There are many outstanding mechanical and operating features of Southern States Pole-Pak phase-over-phase air switches. But the speed and ease of installation are particularly outstanding advantages.

Southern States employs an exclusive, simplified mounting system. Clamp-type steel bands are fastened to the pole at pre-determined positions. No gaining or drilling is necessary, assuring longer pole life. All switch units are assembled on the ground and hoisted into position. Hooks on the switch frame slip over a mounting plate on the top band, providing temporary suspension and automatically lining up mounting holes for quick and easy permanent bolting. It's that simple!

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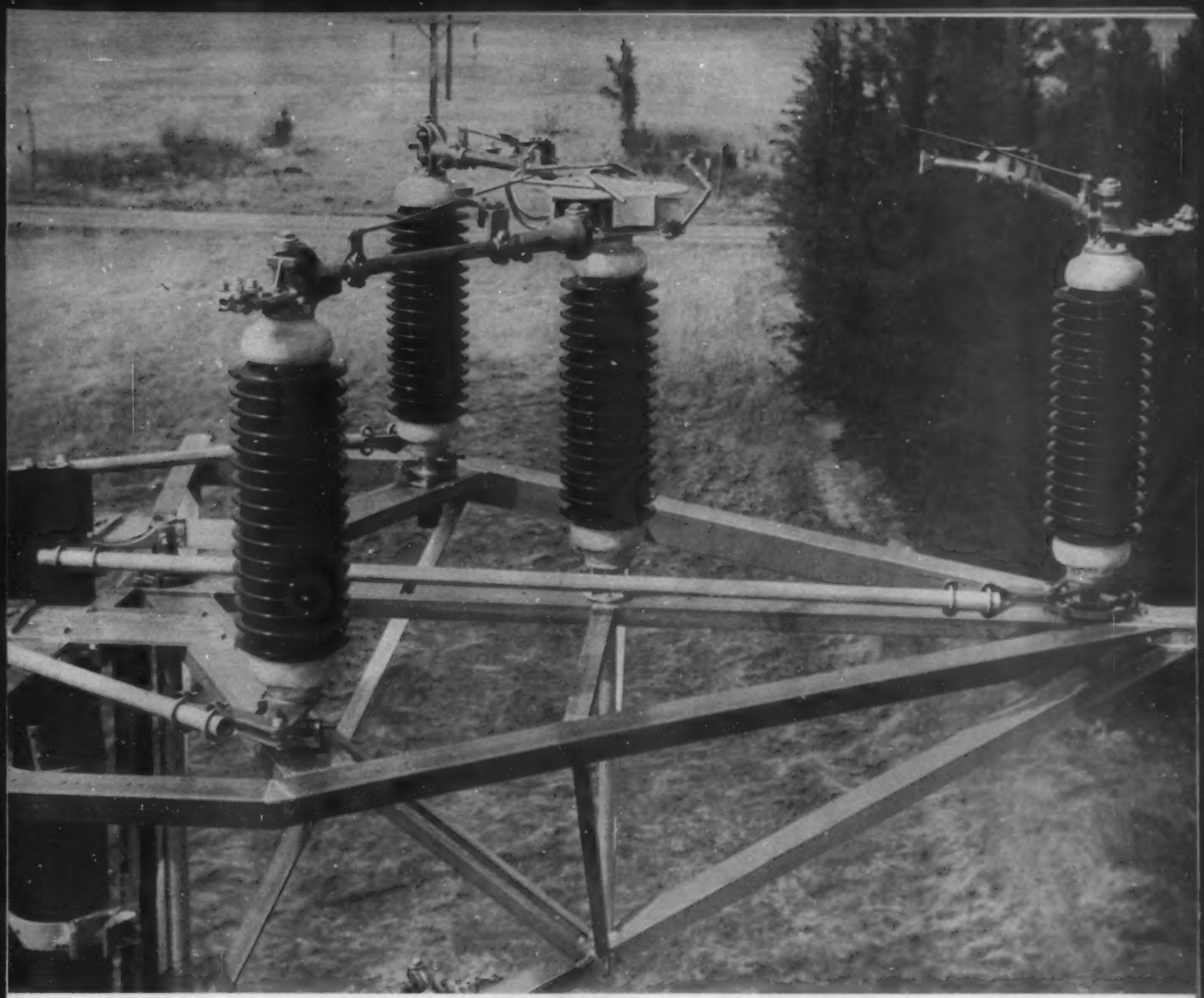
The Pole-Pak uses Southern States Type 57L braidless air switches. These rugged switches are equipped with Amplitact® contacts, time-proved as the most dependable means devised for handling high short currents.

The Southern States 57L switch is unusually easy to operate. Its blade is designed to toggle into the closed position and has no tendency to open. No force from the operating mechanism is needed to keep the switch closed. The switch is easily oper-



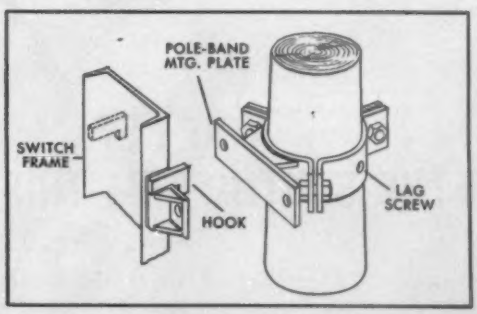
SOUTHERN STATES POLE-PAK is available in voltage ratings from 7.2 kv through 69 kv and continuous current ratings of 600 and 1200 amperes. One- two- or three-way models are available. Southern States Type 57L side-break braidless air switches with Amplitact® contacts are used in the Pole-Pak.

ated by one man, even under icing conditions.

The Pole-Pak frame is constructed of 6061-T6 structural aluminum with adequate bracing for vertical angular pulls in addition to line tensions.

This phase-over-phase method of switching, employing only one pole, with its many time-saving and cost-saving advantages, warrants careful consideration.

Get full information from your Southern States representative, or write for Bulletin 61 PP.



SIMPLIFIED MOUNTING results from exclusive system. Steel band is clamped to pole. Two lag screws prevent slipping. Hooks on switch frame slip over pole-band mounting plate. No drilling or gaining of pole is necessary.

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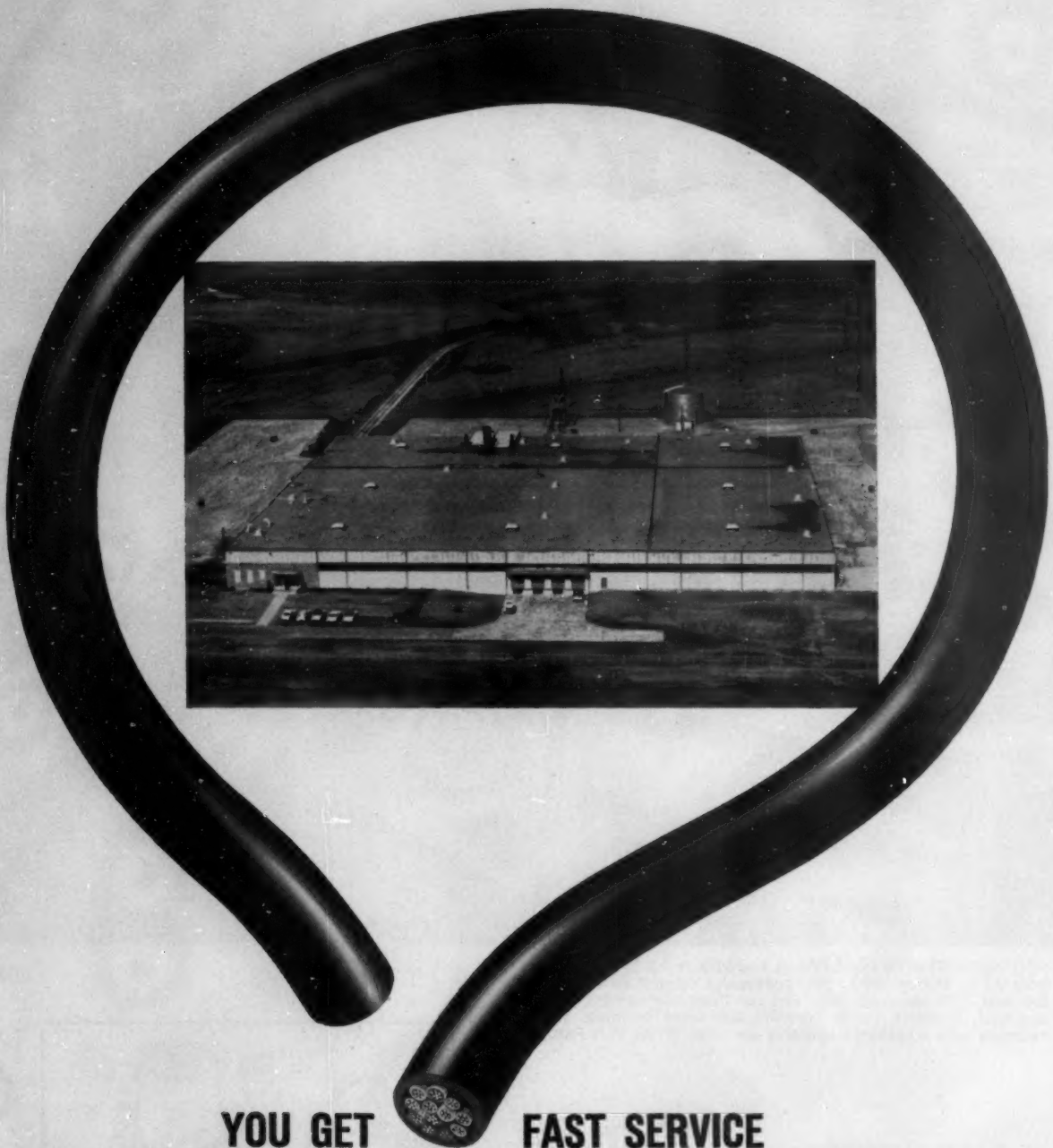

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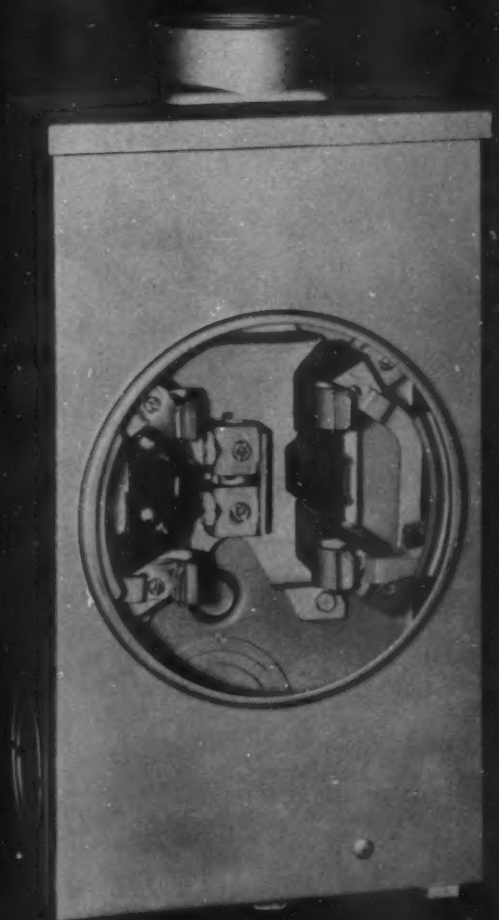

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GENERAL ELECTRIC

Loadbuster works with all four

Portable loadbreak tool is usable with cutouts, disconnects, power fuses, and pad mounted gear

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- Provides full load switching for cutouts and power fuses
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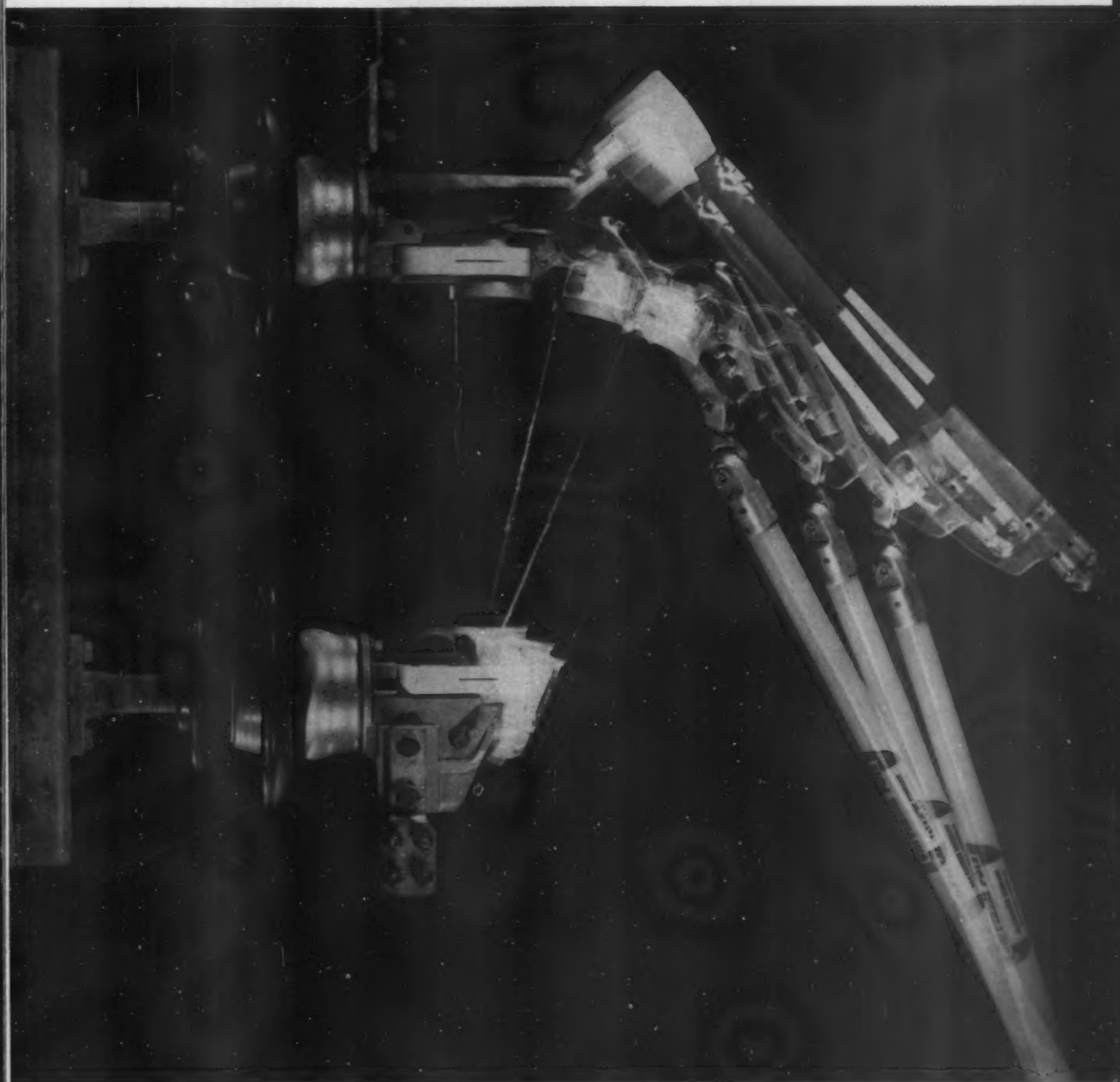
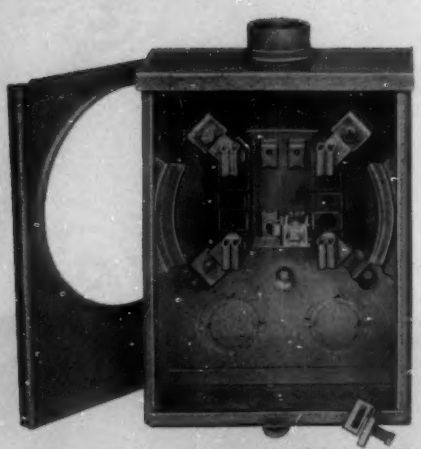
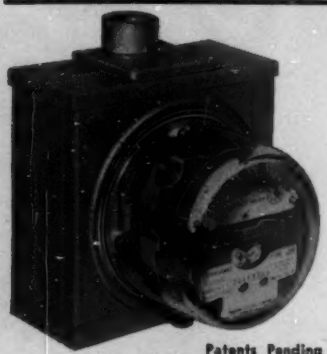


You simply hook Loadbuster across the upper contact of a disconnect or fuse and open it in the normal way. There is no arc, link breakage, contact burning, or danger to the operator. Just disengage the device and it's ready for instant use again.



Patents Pending
CATALOG SL-AL-100FH-1 1/4"
Size 10 1/2" x 8" x 3 5/8"
4 Terminals—100 to 120 Ampere
Aluminum Extruded Connectors



Patents Pending
CATALOG WV-011-A-1-1/4"
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Standard Copper Connectors

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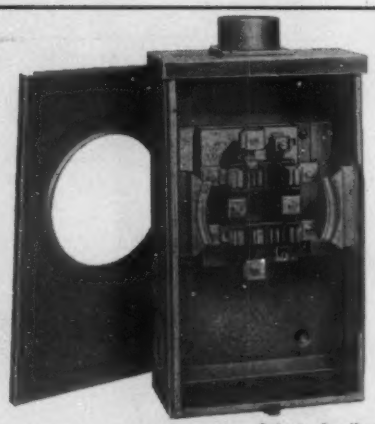

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Aluminum Extruded Connectors

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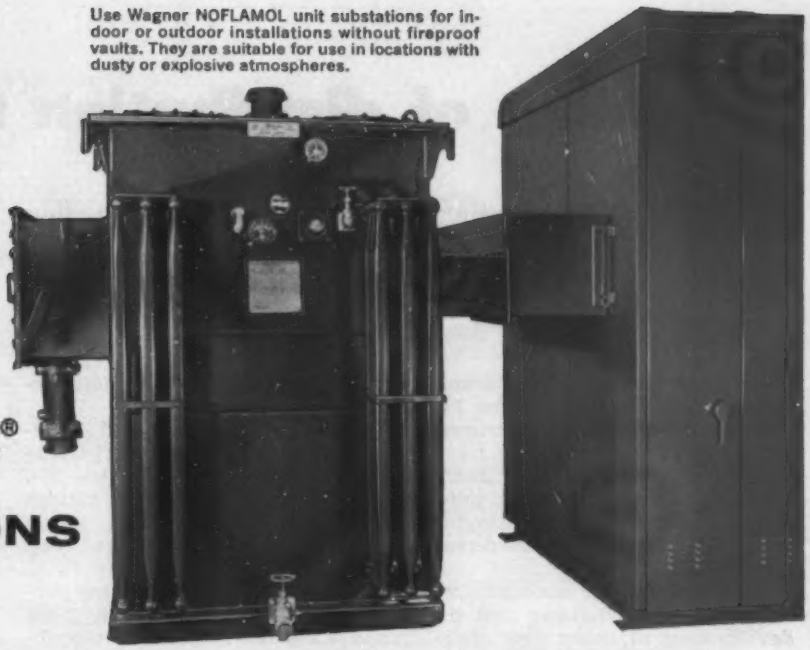

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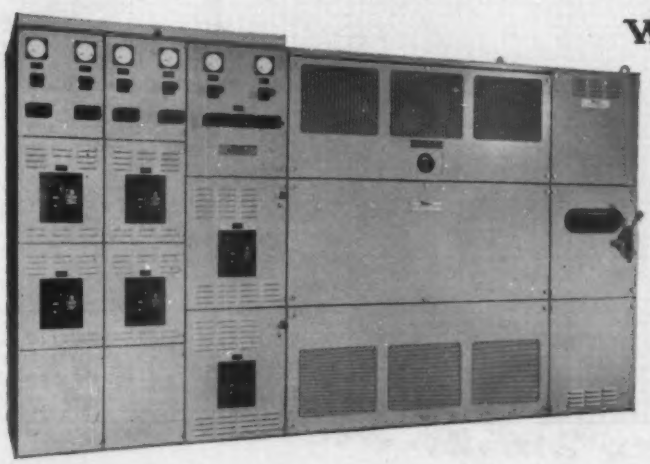
Wagner unit substations are built with transformers rated 112½ through 2000 kva, 3-phase, 60 cycle ratings with high voltages of 2400, 4160, 4800, 6900, 7200, 12000, 13200, or 13800 volts and low voltages of 240, 208Y/120, 480 or 480Y/277 volts.

Four types per NEMA standards are available: sealed dry-type; ventilated dry-type; oil-filled; and Noflamol (non-inflammable liquid-filled).

Wagner Electric Corporation
6440 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.



Your Wagner Sales Engineer

will be glad to help you plan any power distribution system. Get complete information on Wagner unit substations from him, or write us for Bulletin TU-152.

Use Wagner VENTILATED DRY-TYPE unit substations indoors. They perform efficiently in any reasonably dry, dust-free, well-ventilated location. Lightweight makes them ideal for use in multi-story buildings.

WT61-6A

For more details on above items, use reply card on page 19

Loading of distribution transformers

Distribution transformer loading practices were revised to better meet the characteristics of loads caused by new appliances and equipment

By C. C. Wolf, Manager, Transmission and Distribution, The Potomac Edison Co., Hagerstown, Md.

◆ In 1958 we revised our distribution transformer loading practices to better meet the changing characteristics of the loads served by our system.

Increasing use of air-conditioning and electric heating and the development of many new appliances contributed to this change. In addition, it became desirable to consider the effects of the duration of peak load and ambient temperature on permissible transformer loading.

Use of the following information makes it possible to take these factors into consideration.

Now 2,400-120/240- and 7,200-120/240-volt, two-bushing transformers are purchased in ten-, 25-, 50-, 75-, 100-, and 167-kva ratings and 7,200-120/240-volt, single bushing transformers in five-, ten-, and 15-kva ratings.

In 1958 we discontinued the purchase of 15- and 37½-kva, 2,400 and 7,200-120/240-volt, two-bushing transformers, although present stocks and salvage transformers of these ratings continue to be used.

Note on Figure 3 that transformers of these ratings are installed for relatively slow growing loads (less than six per cent annual growth rate) whenever possible and the next larger size installed for faster growing loads.

We have been purchasing transformers with overload indicators since 1951. At the present time all transformers, ten-kva and larger, are purchased with these indicators. Three types of indicators have been supplied and are listed:

(1) Top oil temperature indicator—This indicator operates at 80 C top oil temperature. It is normally supplied on all transformers except those supplied by one manufacturer.

(2) Winding temperature indicator—This indicator operates at 105 C from a thermal element located

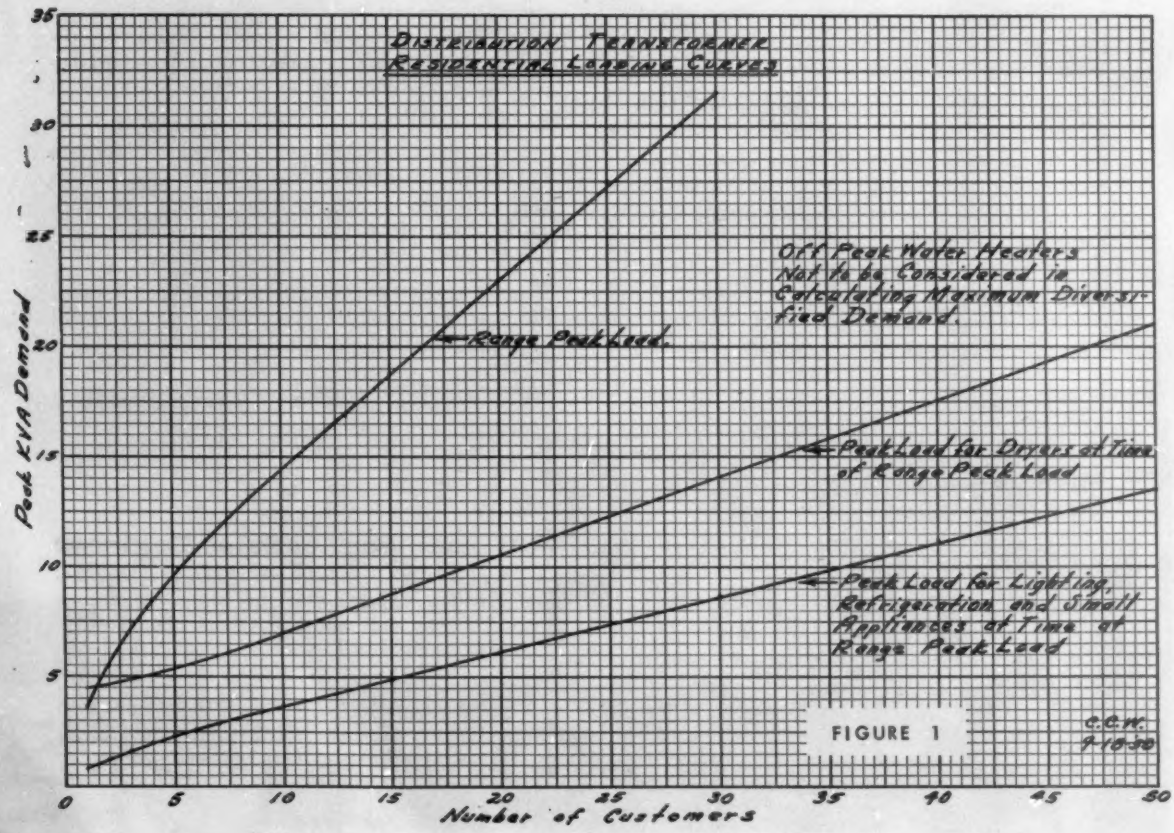
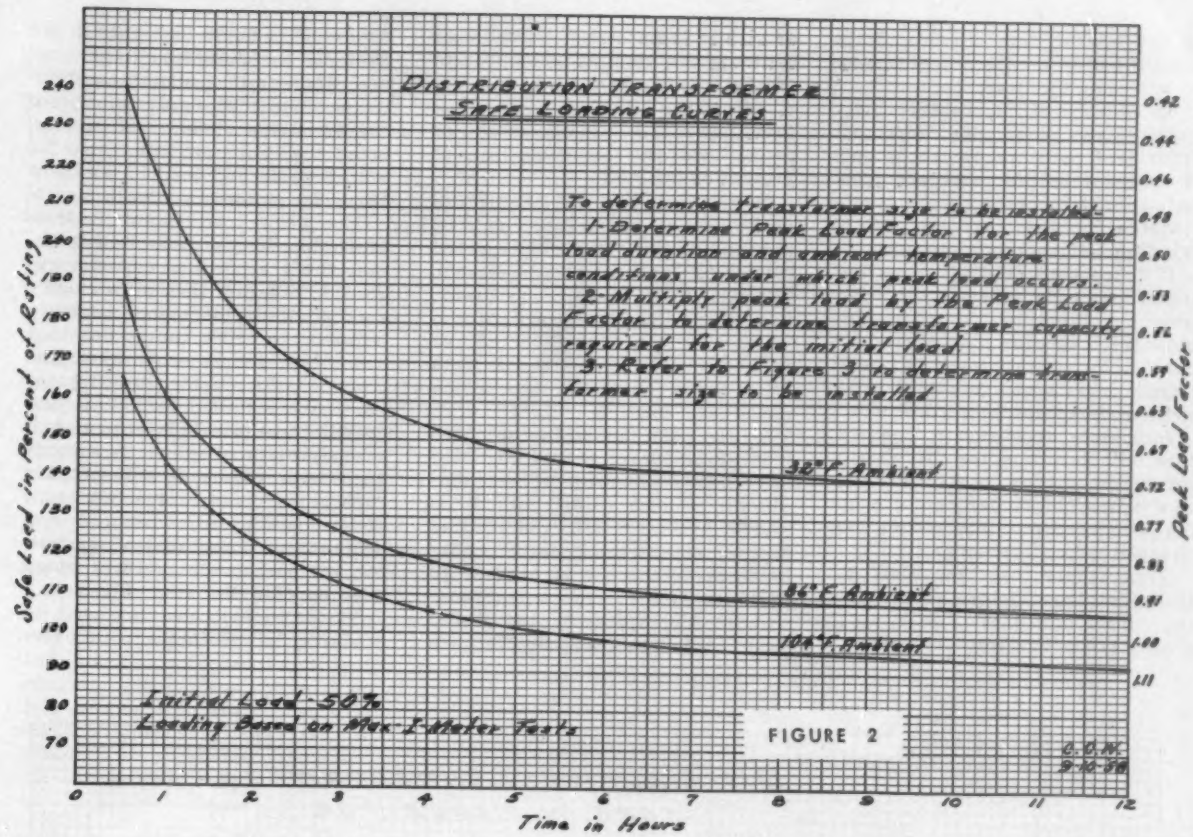
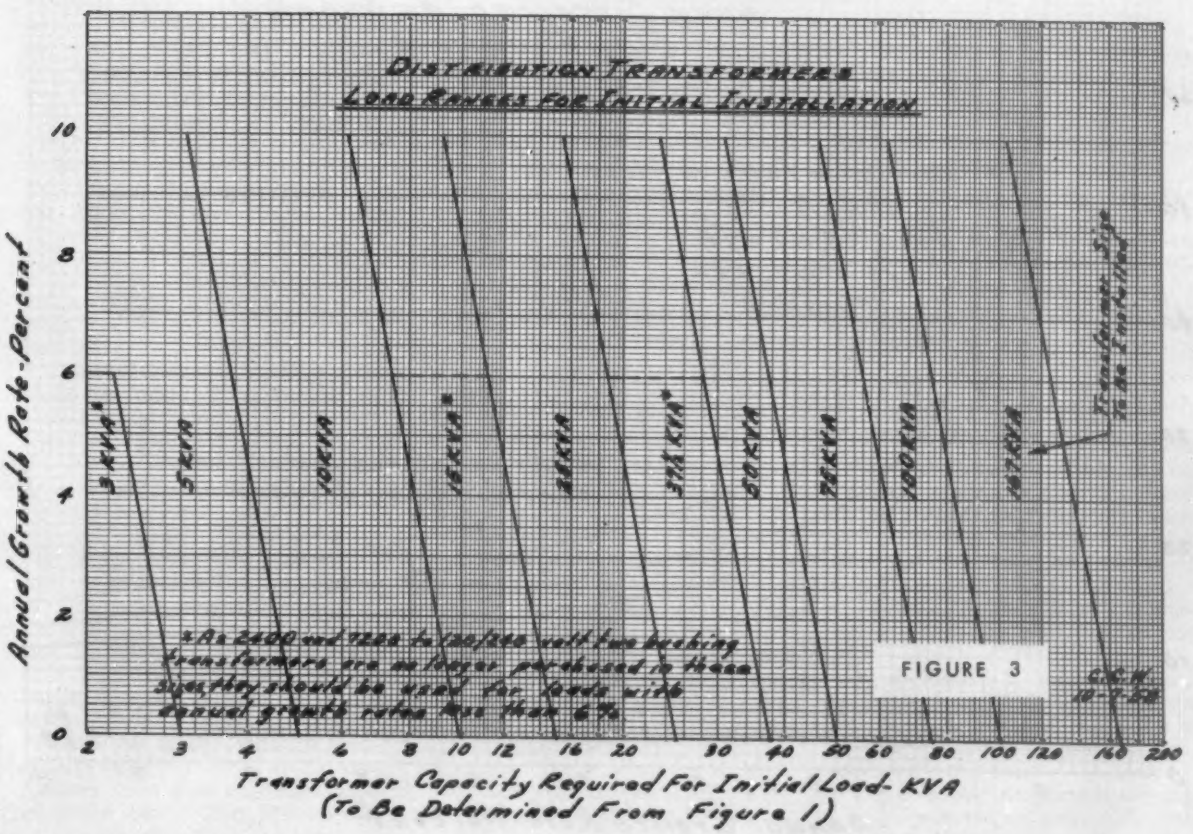


FIGURE 1


DISTRIBUTION TRANSFORMER
SAFE LOADING CURVES
To determine transformer size to be installed:
1- Determine Peak Load Factor for the peak load duration and ambient temperature conditions under which peak load occurs.
2- Multiply peak load by the Peak Load Factor to determine transformer capacity required for the initial load.
3- Refer to Figure 3 to determine transformer size to be installed
32°C Ambient
86°F Ambient
104°F Ambient
Safe Load in Percent of Rating
Peak Load Factor
Time in Hours
Initial Load - 50%
Loading Based on Max-I-Meter Tests
FIGURE 2
C.D.W.
9-12-58


DISTRIBUTION TRANSFORMERS
LOAD RANGES FOR INITIAL INSTALLATION
Annual Growth Rate-Percent
Transformer Capacity Required For Initial Load-KVA
(To Be Determined From Figure 1)
Transformer Size To Be Installed
3 KVA
5 KVA
10 KVA
15 KVA
25 KVA
37.5 KVA
50 KVA
75 KVA
100 KVA
167 KVA
*As 2400 and 7200 to 120/240 volt two bushing transformers are no longer purchased in these sizes, they should be used for loads with annual growth rates less than 6%
FIGURE 3
C.D.W.
10-7-58

in the low voltage winding. It is supplied only on the transformers of one manufacturer.

(3) Tank wall temperature indicator—This indicator operates from tank wall temperature and is compensated for ambient temperature. Its operating point is adjustable between 85 and 105 C winding hot spot temperature.

It has been supplied on a few transformers of one supplier and several hundred magnetically mounted indicators have been purchased for installation on older transformers which are in service without overload indicators.

Indicators received in the future will be set on the "H" (high) setting to operate at a 105 C hot spot temperature. Indicators originally set on any other setting are changed when convenient.

Transformer sizes for new installations are determined using the curves and data of Figures 1, 2, and 3. To determine transformer size it is necessary to know or estimate the amount and duration of the initial peak load, ambient temperature during the peak (whether it is a summer or winter peak), and the expected rate of growth of the load.

Initial peak load for commercial or industrial installations can be determined fairly accurately as the connected load is usually known. For residential loads it is convenient to use the curves of Figure 1, which give the peak demands for various residential loads. All peak loads are given at the time of the range peak load.

To the peak demand determined from these curves should be added any electric heating or air conditioning load. Until more is known about the effect of heating and air conditioning, no diversity between customers is applied to these loads.

After the value of the initial peak load has been determined, reference is made to Figure 2. We estimate the duration of the peak and whether it occurs in the winter or summer and determine from Figure 2 the peak load factor, using the 32 F ambient curve for winter peaks and the 86 F ambient curve for summer peaks.

The peak load factor is then multiplied by the peak load to obtain the transformer capacity required to serve the initial load.

After the transformer capacity required to serve the initial load has been found, we determine from Figure 3 the transformer size to be installed for the annual growth rate which is anticipated. Transformers installed in accordance with Figure 3 will provide sufficient capacity for a minimum of five years load growth.

Maximum years of load growth for various annual growth rates may be obtained from Figure 4.

No Max-I-Meter checks need be made on transformers with over-

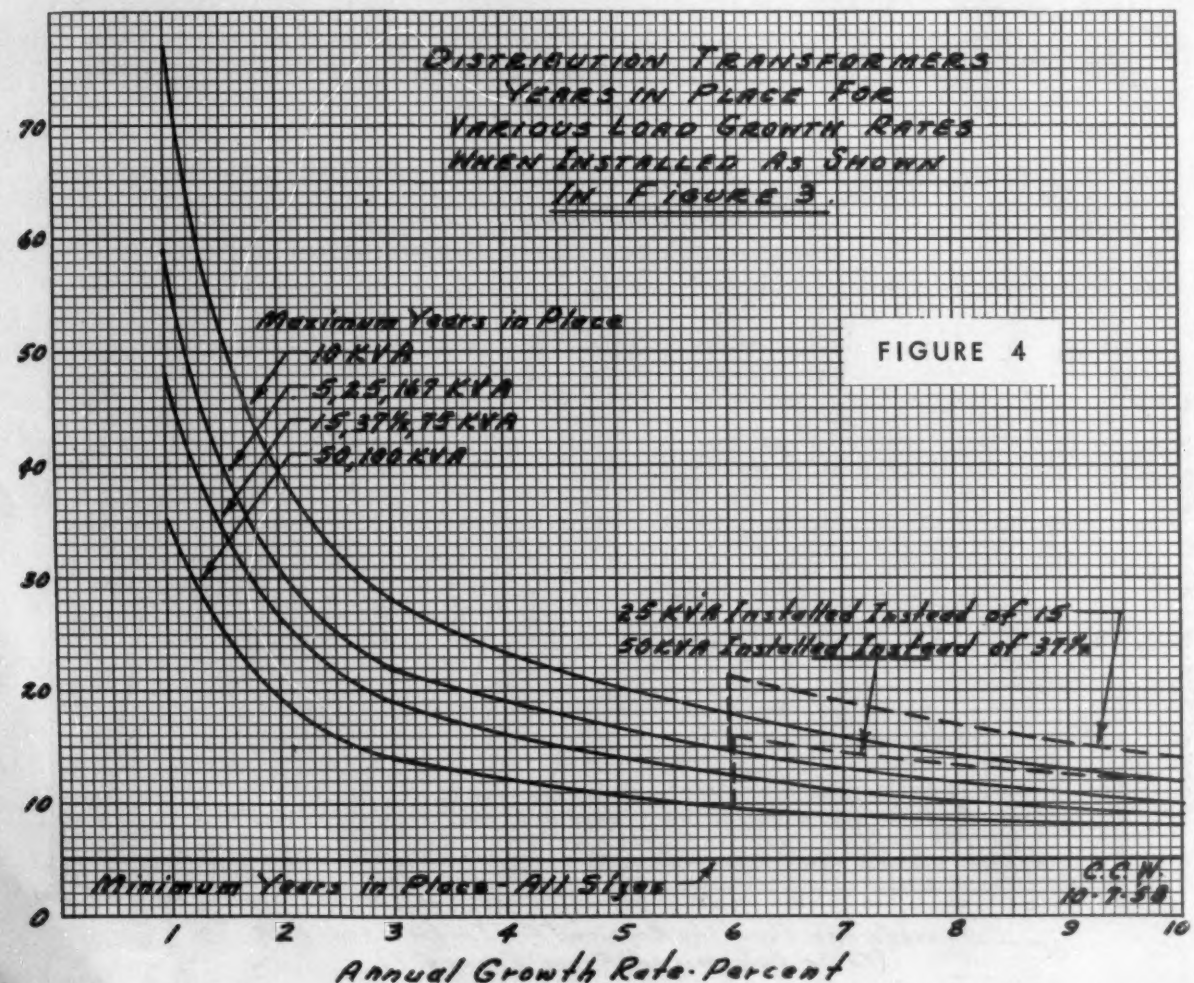


FIGURE 4

load indicators, as the indicators are set to operate at approximately the maximum safe load which the transformer can carry. However, the indicators should be observed on a regular schedule such as is used for checking with Max-I-Meters those transformers without overload indicators.

It has always been our standard practice to replace with a larger transformer any transformer on which the overload indicator has operated, unless some transient or temporary cause of the overload is suspected. No Maxi-I-Meter check need be made unless there is some reason to believe the overload indicator is not operating properly.

Curves giving the operating characteristics of the top oil temperature indicator and the tank wall temperature indicator are given in Figures 5 and 6.

The three- and five-kva transformers *without* overload indicators usually serve single customers and are too numerous to justify checking with Max-I-Meters. For this reason, these transformers are replaced on the basis of the monthly kwh use of the customers served. Replacement is according to the following schedule:

Three-kva transformers with 800 to 1,000 kwh per month are replaced with a five-kva transformer, and three-kva transformers with 1,000 to 2,000 kwh per month are replaced with a ten-kva transformer.

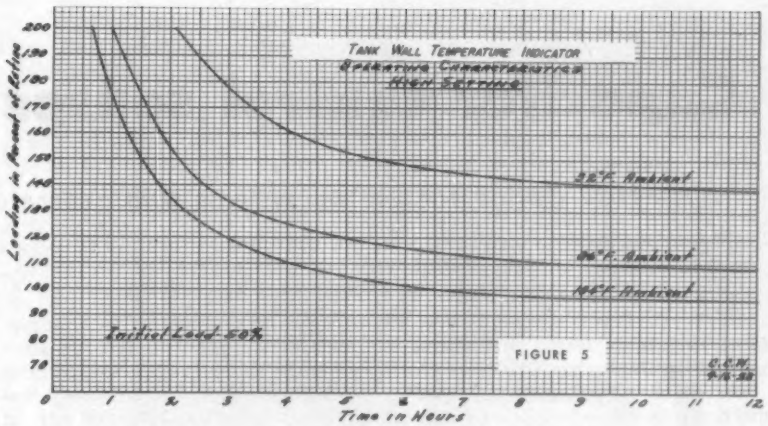
Five-kva transformers with 1,500 to 2,000 kwh per month are replaced with a ten-kva transformer, and with over 2,000 kwh per month there is a need for a Max-I-Meter check.

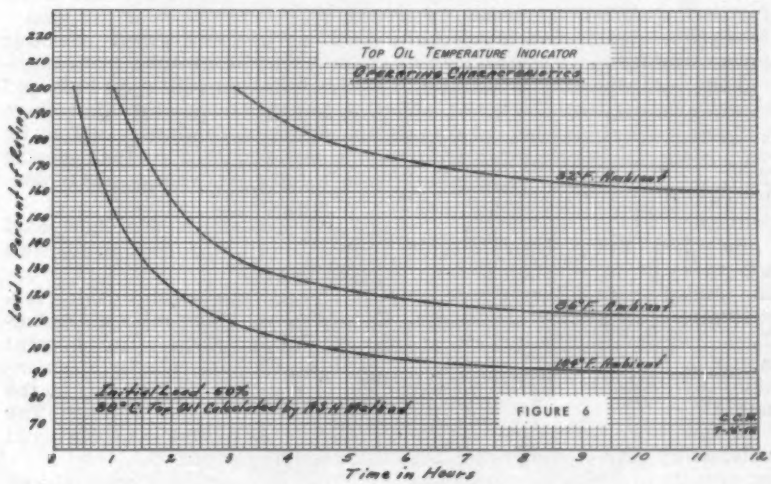
Ten-kva transformers and larger should be checked periodically by means of Max-I-Meters or, when available and applicable, billing demand meters.

Transformers should be replaced when the load, as determined by Max-I-Meters, reaches the safe operating load as determined from the curves of Figure 2. Note that duration of peak load and ambient temperature must both be taken into consideration in arriving at this figure.

In determining the proper size of the replacement transformer, the same procedure as outlined for new installations should be used.

As load checking is carried out on an around-the-year basis, the following table may be used in determining peak loads on residential and commercial area transformers from load readings taken at times other than the normal





November-December peak. *This table should not be used for loads involving air conditioning or electric heating.* Transformers with these loads should be checked during the expected peak load.

Month test made	Estimated % of annual peak
January	100
February	95
March	90
April	85
May	80
June	75
July	75
August	75
September	80
October	90
November	100
December	100

Transformer cards are not suitable for carrying a history of the location, particularly because the card is moved when the transformer is moved. For this reason, as information on load, services, and appliances is accumulated, it is carried on a white card filed with the transformer card. This card then remains as a history of the location if the transformer card is removed.

Following are two sample calculations:

(1) New installation to serve 12 residences in new development, six ranges, six dryers.

From Figure 1, the expected demand is,

12 lighting customers	4.1 kva
6 range customers	10.6 kva
6 dryer customers	5.6 kva
	20.3 kva

The peak load can reasonably be assumed to occur in the winter and be of about two hours duration. From Figure 2, determine on the 32 F curve a peak load factor of 0.57.

0.57 x 20.3 = 11.6 kva transformer capacity required for the initial load.

From Figure 3, using a typical annual growth rate of six to seven per cent, it is determined that a 25-kva transformer should be installed for this load.

(2) Existing installation serving

(Continued on page 118)

Capacitor control senses both current

New device for use on systems with generator bus voltage control utilizes

By R. C. Odell, Capacitor Section, Regulator Dept., Allis-Chalmers Manufacturing Co.

◆ Distribution and subtransmission circuits of utilities everywhere are studded with capacitors for improving voltage levels, bettering line loading with more real power, and lowering system losses.

The methods used in different power systems vary. However, all systems have a number of fixed or unswitched banks for base or light load conditions and other banks that are switched on as loads increase.

Switched units, either in pole top racks or in substation stacking racks or enclosures, may be activated by a variety of controls. Each installation requires an analysis of the line and load conditions to determine its particular needs.

A new capacitor control was developed by Allis-Chalmers for use on circuits in which generator bus voltages are increased with load.

On this type of operation the peak load voltage usually exceeds or nearly equals the light load voltage at any point on the system. A capacitor control on such a system that is responsive to both voltage and current will keep unwanted reactive kilovars off at light loads, but will switch in the necessary capacitors at full load.

The straight voltage sensitive control which switches off capacitors when the voltage is high and switches them on when the voltage is low is used but is modified by the addition of a current sensing device to give two plateaus of operation.

One plateau is for light load periods and the second for full load periods.

The voltage sensing device is a voltage regulating relay of the balanced beam type. The current sensing element consists of an inductive pickup coil located in the base of a post type insulator. The coil voltage output is proportional to the line current.

The elementary circuit shown in Figure 1 shows the basic parts of the capacitor switching system.

The control actually operates as a voltage sensitive control but is wired so that when a preset value of load current is reached the current bias shorting relay contact opens and inserts a resistance in the voltage regulating relay circuit.

The voltage across this relay decreases enough to cause the balance beam to energize the timer. Subsequently the capacitor "close" relay functions thereby switching capacitors onto the system.

As load current decreases below approximately 70 per cent of the pickup value the current bias resistor is short circuited by the shorting relay and the panel reverts back to the initial plateau of operation as a voltage sensitive control only.

How it functions

With these plateaus of operation, the control functions as follows:

(1) During light loads the capacitors are kept off unless the voltage falls to an abnormally low value, in which case they are switched on to bolster the voltage. Light load periods are accompa-

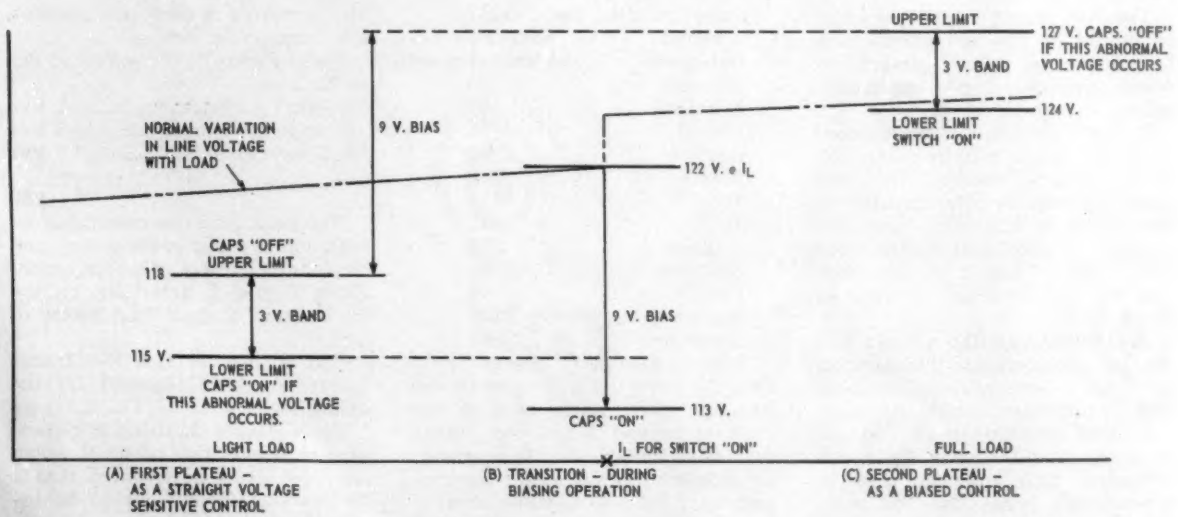

UPPER LIMIT
127 V. CAPS. "OFF" IF THIS ABNORMAL VOLTAGE OCCURS
3 V. BAND
124 V.
LOWER LIMIT SWITCH "ON"
NORMAL VARIATION IN LINE VOLTAGE WITH LOAD
9 V. BIAS
122 V. ± I_L
CAPS "OFF" UPPER LIMIT
118
3 V. BAND
9 V. BIAS
115 V.
LOWER LIMIT CAPS "ON" IF THIS ABNORMAL VOLTAGE OCCURS.
113 V.
CAPS "ON"
LIGHT LOAD
I_L FOR SWITCH "ON"
FULL LOAD
(A) FIRST PLATEAU – AS A STRAIGHT VOLTAGE SENSITIVE CONTROL
(B) TRANSITION – DURING BIASING OPERATION
(C) SECOND PLATEAU – AS A BIASED CONTROL

Fig. 1—The first plateau of operation is at light loads and the second is at heavier loads. The switching point of current bias shorting relay can be set in the field in order to suit load system and voltage characteristics.

and voltage

insulator pickup coil

nied by satisfactory but lower voltages than are had during peak load periods. Unwanted ckvar is kept off the line.

(2) As the load increases, the system voltage increase will provide satisfactory voltage conditions. The capacitor control, acting on a voltage signal only, will cause capacitors that were switched on under low voltage conditions to be switched off.

(3) Under peak loads, when the capacitors are needed most, the load current will activate the control device to switch all the capacitors on, providing a low loss high power factor system.

If an abnormal situation develops in which the voltage on a particular line goes too high the voltage sensing part of the control circuit will override the current portion and switch capacitors off.

This situation could develop if two or more circuits normally feed an area. In such a case the voltage will increase because of increased reactance back to the source when one line is out of service.

The novel control operates on two plateaus of system load to switch capacitor banks for voltage correction and reactive kilovar supply. The control is readily adjusted in the field to meet operating conditions.

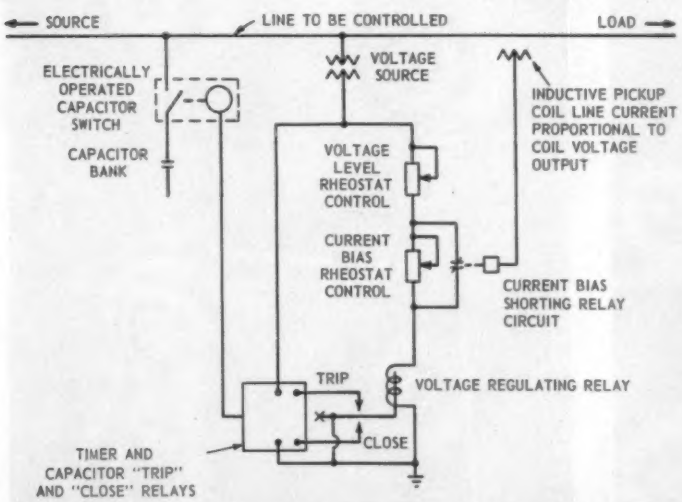
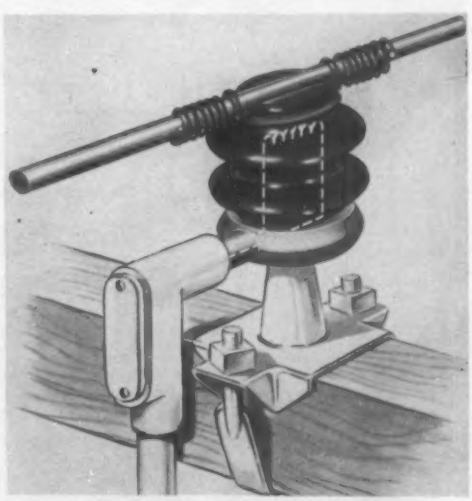


Fig. 2—Current bias shorting relay operates on signal from inductive pickup coil that produces voltage proportional to line current.



Pickup coil in the insulator (designed by Fisher-Pierce) provides measure of line current.

Illustrative example

As an example, some general values can be chosen, as shown in Figure 1, to illustrate the operation of the control.

A study of a given circuit may show that for straight voltage control, the upper voltage limit should be set at 118 volts with a band width of three volts, thus establishing the lower limit at 115 volts. The system voltage would usually be above these values, but the capacitors would be switched on if the voltage fell to 115 and off if it rose above 118 volts.

An integrating timer, which may be manually adjusted up to 140 seconds, prevents unwanted

(Continued on page 117)

Southern plant to use aluminum transmission towers

◆ Aluminum electrical transmission towers, said to be the first used in this area, will carry power over all-aluminum cables to the new silicon producing plant at the Reynolds Metals Company Listerhill reduction plant at Sheffield, Ala.

Plant crews have completed the assembly and erection of the eight 47-foot aluminum towers and strung them with high capacity aluminum transmission cable produced at the adjoining Reynolds Metals alloys plant.

Reduction plant manager R. B. Newman said the new towers were designed with extra strength to permit future installation of transmission lines to serve more silicon furnaces. Operation of the one furnace now installed is expected to begin soon.

Mr. Newman said substantial maintenance savings are expected on the aluminum towers since they won't rust and never need paint.

Albert E. Wolfe, plant project engineer, said assembly of the aluminum towers went much faster than with steel towers because of aluminum's lighter weight. No rigging was needed for tower assembly, he said, since they were assembled on the ground and were easily set in place with a 15-ton crane.

The towers, of three different types, ranged in weight from 2,400 to 3,500 pounds, Mr. Wolfe said, or about half what equivalent steel towers would have weighed.

The Reynolds 5005 aluminum transmission cable used, Mr. Newman said, has proven highly popular for electrical transmission lines because it weighs far less than equivalent copper cable and fewer towers or poles are needed to carry it across country.

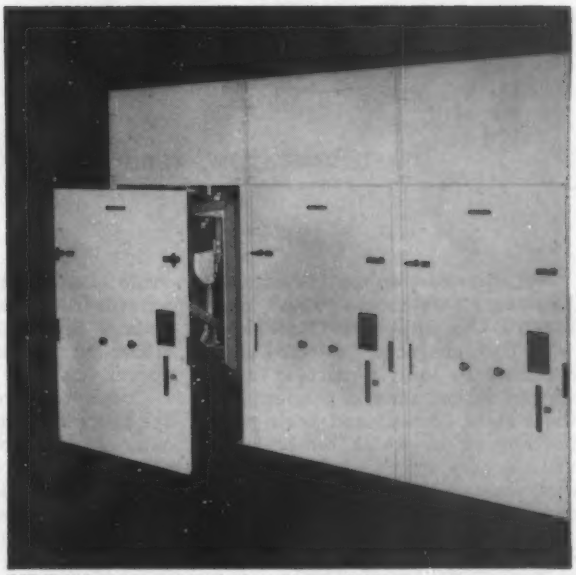
The aluminum transmission cables now installed to serve the silicon plant have enough capacity to carry power to more than 2,000 average homes, he said, but because these high capacity cables are so light, the aluminum towers could be placed 450 feet apart.

The aluminum towers, he said, are winning favor with power transmission operations because of their lower weight and freedom from maintenance. This proves particularly important, Mr. Newman said, in inaccessible areas and in some areas helicopters are being used to place the aluminum towers in place rather than dragging them overland.

An aluminum tower is being set in position at the plant.

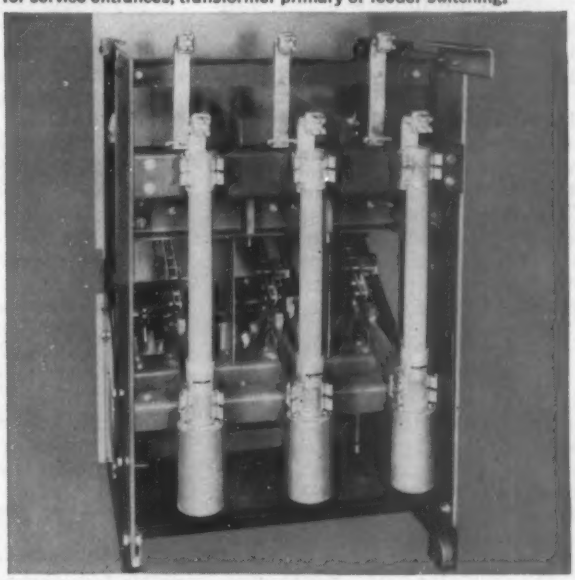
The strong towers will allow installation of more lines.

New...Low-Cost, Drawout DFS Metal-Enclosed Load-Interrupter Switchgear



DFS Switchgear comes in single units or switching centers, as shown, for service entrances, transformer primary or feeder switching.

DFS drawout switch and fuse element is easily levered into cell.



DFS switch and fuse element, rear view.

Type DFS Metal-Enclosed Switchgear—*drawout fused switch*—provides compact, low-cost power switching for high voltage circuits in commercial buildings, institutions, and small industrial plants. DFS Switchgear meets a wide range of applications—with fault interrupting ability up to 250 mva at 4160 volts and 500 mva at 13,800 volts . . . load break rating 600 or 1200 amperes . . . full fault closing ability of 60,000 amperes for 5 kv and 40,000 amperes for 15 kv.

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J-61011-R1

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Characteristics of substation loads

The temperature, time of day, time of week, and season change the load,

By Clark Denison, Planning Engineer, Oklahoma Gas and Electric Co., Oklahoma City, Okla.

◆ The character of the load supplied by any particular substation is not only dependent on the classes of load and their proportions of the whole, but on such variables as temperature, time of day, time of the week, and season of the year.

The varying quantities and diversities between elements of the loads as viewed from the substation result in quite a wide variation in power and reactive components to be supplied during the year.

The problems arising from these load variations call for versatile equipment and techniques to provide dependable service at acceptable voltage levels economically. To cope with these problems, equipment and operating techniques on the circuits supplied are involved as well as those confined to the substation.

General characteristics

The usual classifications of loads include residential, rural, commercial, and industrial. These, with such small and growing classes as street lighting, schools, government, etc., comprise the loads for which service must be provided by substations and their associated distribution circuits.

Urban residential loads have been increasing rapidly due primarily to population movement to cities, especially the larger ones. The major part of this load is now associated with electric cooking, water heating, and air conditioning, with a small but rapidly increasing portion of house heating.

The formerly predominate lighting and refrigeration loads are still growing, but at slower rates than that of the major appliances.

Rural loads are assuming quite diverse characteristics. Use of mechanized equipment is increasing on the fewer active farms remaining. More light industry, oilfield pumping, and commercial loads along highways are being served in rural areas. Very few active farms remain unserved either by utilities or by REA cooperatives.

Commercial loads in urban areas are becoming widely dispersed because of the advent of residential area shopping centers. More new loads contain high proportions of motor loads for complete air conditioning, refrigeration, and other mechanized operations, in addition to higher lighting levels.

Industrial loads are becoming quite common even in small communities, which in most cases have set aside areas and in some cases purchased sites to encourage them. Most light and medium industry has a relatively low load factor due to an eight-hour day operation, but larger industries, such as petroleum, cement, glass, etc., lend themselves to continuous 24-hour operation, resulting in high load factor.

Expressways and traffic arteries in and adjacent to larger cities are being lighted to increasingly high intensities. Our company has budgeted over a million dollars for urban thoroughfare lighting alone during the next three years. New schools also have high lighting levels and many have complete air conditioning, as well.

Individual characteristics

Various combinations of these loads result in quite a varied pattern of substation load profiles. Typical of these on the Oklahoma Gas and Electric system are the following:

(1) Substations serving predominately residential loads have their annual peaks about 5:30 p.m., with a secondary peak at 9:00 p.m., on a hot humid day of a prolonged high temperature period. Peak loads may even occur on Sunday in such areas.

Monthly peak loads for such months as March or April may be only 50 per cent or less of the annual peak with light loads of 20 per cent or less of peak value. Figure 1 shows charts on such a substation for light load and peak load conditions.

(2) Average proportions of commercial, industrial, and residential loads usually result in annual peaks about 3:00 p.m. of a weekday in summer, after three or four consecutive high temperature days. Figure 2 shows charts for an average substation for light load and peak load conditions. Thus, system peaks occur at such times.

(3) Some small substations whose load is chiefly cotton gins or mills and schools usually have their annual peak loads during the fall season.

(4) Substations with a high percentage of heat sensitive load, such as air conditioning, pumping, refrigeration, etc., are subject to relatively large decreases during summer storms involving sudden temperature drops. The var load decreases much more than the power components in such cases, resulting in a sharp power factor increase.

The peak load charts in Figure 1 show the sharp drop in load between the load on the first and second days which resulted from a temperature drop from 95 F to 76 F maximum. Both of these are weekdays.

As a result of these varying load characteristics, the diversity between substation loads is significant. A recent study made on the Oklahoma Gas and Electric Company system indicates diversities calculated at the times of each individual substation's peak may vary from 1.09 to 1.5., with the lower value occurring at the time of the annual system peak load.

This diversity tends to reduce peak loads on bulk substations and transmission lines.

Power factors

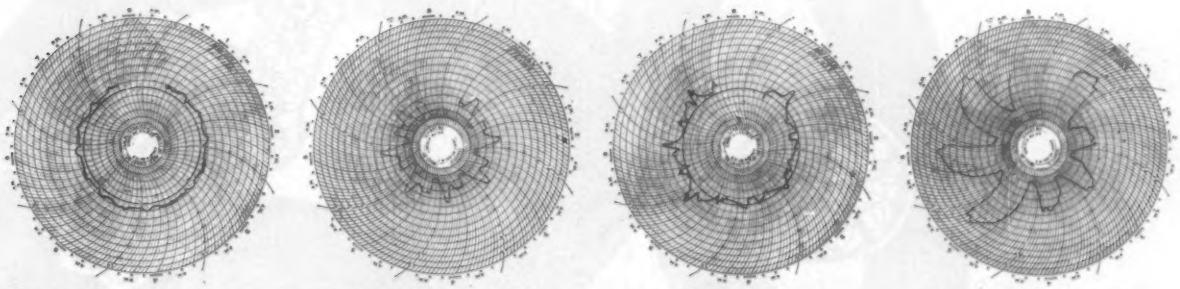
Our economic studies have indicated increasingly high system power factors are desirable in view of the large decreases in costs of corrective capacitors. Our efforts to maintain high substation power

and problems their variations cause

and utilities need versatile equipment and techniques to meet these changes

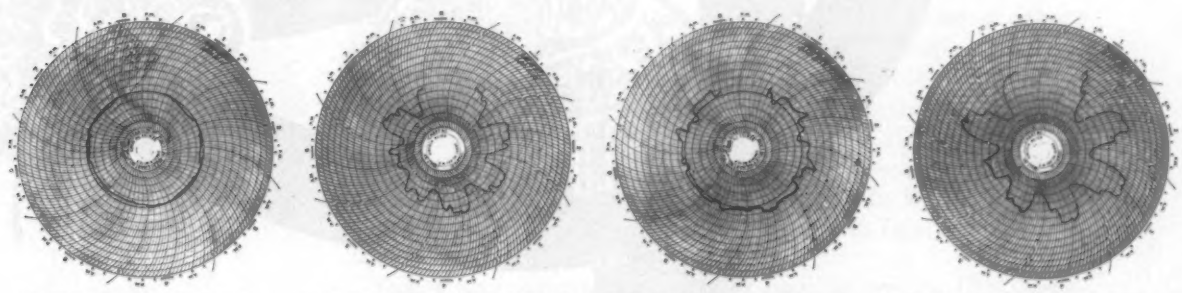
factors have been aided to some extent by higher operating power factors associated with the newer models of motorized appliances.

This, together with lower impedance distribution transformers, has improved basic load power factor. Our experience in spot transformers tests shows that low use residential customers having few major appliances have summer power factors in the 70's



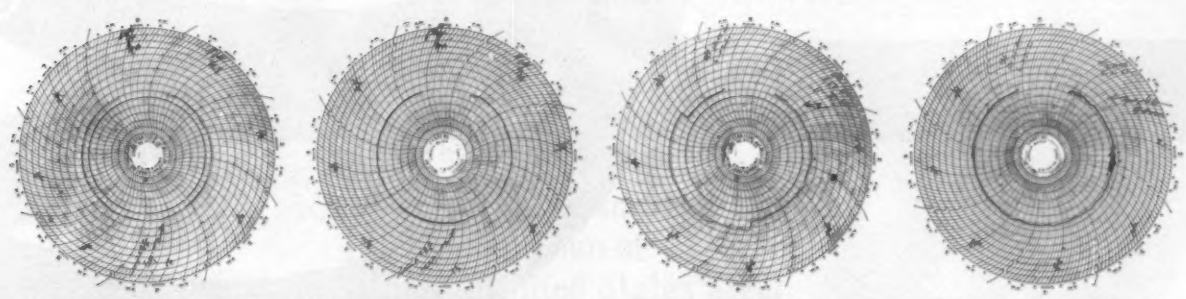
a. Light Load Period Var Chart b. Light Load Period Watt Chart c. Peak Load Period Var Chart d. Peak Load Period Watt Chart

Fig. 1—These four charts point out the light and peak load conditions for a substation serving predominately residential loads. The peak load charts show the sharp drop in load from the first day to the second day which resulted from a temperature drop from a 95 F maximum the first day to a 76 F maximum the second day.



a. Light Load Period Var Chart b. Light Load Period Watt Chart c. Peak Load Period Var Chart d. Peak Load Period Watt Chart

Fig. 2—These charts are for an average substation for light load and peak load conditions. The average proportions of commercial, industrial, and residential loads usually result in annual peaks about 3:00 p.m. of a weekday in summer, after three or four consecutive days of high temperatures. Charts serve as references.



a. Light Load Period Var Chart b. Light Load Period Watt Chart c. Peak Load Period Var Chart d. Peak Load Period Watt Chart

Fig. 3—Here the charts show loads on an oil refinery substation during system light and peak load periods illustrating the relatively small daily or seasonal variations of load where high proportion of load is industrial.

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Table 1 – Methods of controlling capacitors

			Kvar	% of Total
1.	Capacitors on Distribution Circuits			
	1.1 Fixed Capacitors (some seasonally switched)		136 376	28.3
	1.2 Switched capacitors			
	1.21 Time clock control	125 040		26.0
	1.22 Thermal control	121 335		25.2
	1.23 Automatic current control	600		.1
	1.24 Automatic voltage control	9 120		1.9
	1.25 Manual control	2 700		.6
			258 795	53.8
Total fixed and switched on distribution circuits			395 171	82.1
2.	Capacitors in Substations			
	2.1 Time clock control	11 670		
	2.2 Thermal control	600		
	2.3 Time compensated voltage control	12 420		
	2.4 Automatic voltage control	20 670		
	2.5 Automatic current control	2 520		
	2.6 Current compensated voltage control	6 300		
	2.7 Var control	2 100		
	2.8 Manual supervisory remote control	19 944		
	2.9 Manual control only	9 990		
			86 214	17.9
3.	Total Capacitors on System		481 385	100.0

whereas the higher use customers' power factors are in the 80's or low 90's.

Winter power factors for both classes are usually well into the 90's.

Where residential loads predominate, substation daily load curves usually indicate relatively high evening peaks in the winter with low load factor, whereas the summer curves show highest loads during the day, with secondary peaks in the evening hours with consequent higher load factor.

Much less seasonal variation is apparent in loads having high proportions of industrial load. This is illustrated by charts in Figures 1 and 2. Such loads as oil refineries, and cement and glass plants have almost constant loads the year round.

Figure 3 shows load charts on an oil refinery substation during system light and peak load periods illustrating the relatively small daily or seasonal variation of load.

Rural area substations in general have less seasonal variation than those in urban areas due to increased mechanized operations in fall and winter, as well as oil pumping and other loads less subject to seasonal variation.

Determination of loads

Our approach to solving the problems of substation loads is to first determine load characteristics at each substation by an adequate metering system. On our system this is accomplished by installation of ampere demand meters on all feeders and each transformer in a substation associated with separate current transformers or metering accuracy bushing current transformers.

Transformers or banks of 500 kva or more usually have these bushing current transformers and temperature indicators. In major substations or multi-bank stations thermal type kilowatt and kilovar totalizing meters are installed for each distribution voltage. Bus connected thermal voltmeters are also part of our standard installation.

Peak loads for each calendar month are read and reported for general distribution quarterly and charts of recording instruments, such as shown in Figure 1 and 2, are kept for reference.

The data from charts and maximum indicating readings are useful in a variety of ways. A few of these are:

(1) Operators can determine transformer tap settings, regulator ranges, timing of disturbances, etc., from voltage charts.

(2) Operators can monitor transformer heating and loading and thus forecast need for overhaul or capacity increases of thermally limited equipment.

(3) Planners can forecast need for expanded capacity either as expansion of existing or establishing new substations.

(4) Planners can forecast need for power factor corrective equipment both in substations and on associated circuits and operators can determine best suited control methods.

Regulation problems

Starting at the generating station the regulation in step-up transformation and transmission lines is largely compensated for by use of generator voltage schedules attuned to the general system daily and seasonal load variations.

When our system consisted of primarily 66-kv transmission, that voltage was used in setting schedules, but the change to 138 kv and 161 kv at generator step-up

Table 2 – Transformer load capabilities (peaking loads) in kva

Bank Kva N.P. (OA)	Self-Cooled Normal	Self-Cooled Emergency	Fan-Cooled Normal	Fan-Cooled Emergency
1 000	1 100	1 400	1 300	1 600
1 500	1 650	2 100	1 950	2 400
2 000	2 200	2 800	2 600	3 200
2 500	2 750	3 500	3 250	4 000
3 000	3 300	4 200	3 900	4 800
3 750	4 125	5 250	4 875	6 000
4 500	4 950	6 300	5 850	7 200
5 000	5 500	7 000	6 500	8 000
6 000	6 600	8 400	7 800	9 600
7 500	8 250	10 500	9 750	12 000
10 000	11 000	14 000	13 000	16 000

Bank Kva N.P. (OA)	1st Stage of Fans* Normal	1st Stage of Fans* Emergency	Fan-Cooled Normal**	Fan-Cooled Emergency***
12	18	22	22	26
15	22.5	27.5	27.5	32.5
18	27	33	33	39
21	31.5	38.5	38.5	45.5
24	36	44	44	52
27	40.5	49.5	49.5	58.5
30	45	55	55	65

*If portable fans are used, use 1.3 normal and 1.6 emergency multiplier.
**For second stage rating, use 1.1 multiplier.
***For second stage rating, use 1.3 multiplier.

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- Mechanical interlocks insure a closed grounding and shorting switch before cubicle doors can be opened.
- Dead-front control compartment isolates the circuit breaker and grounding switch.
- Vacuum switch or circuit breakers can be supplied.
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- Viewing window in rear of entrance cubicle for visual check of grounding switch position.
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Capacitor enclosed equipment available for 2400 through 13,800-volt, three-phase service, up to 6000 kvar. Allis-Chalmers also offers outdoor stack-racks and pole-mounted racks as well as current and voltage sensitive controls.

Allis-Chalmers extended foil design capacitors withstand higher inrush currents. Current densities are lower at point of contact between the packs and the contact plates than is possible with conventional tab-type capacitor construction.

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stations has made the higher voltage more suitable for setting these schedules.

The trend to higher impedances associated with larger and higher voltage transformers has increased the substation regulation problem. Where higher distribution voltages such as 12.5 kv and above are in use the load tap changer has become almost the exclusive regulating means.

In lower voltage distribution stations, particulary those supplied by lower voltage subtransmission, however, individual feeder regulation, preferably by single-phase regulators, is still the best regulating method.

We have found the use of Minimax voltmeters at feeder centers helpful in maintaining voltage balance in some cases. Use of tap changers on bulk stations makes it profitable to use larger regulating capacity available at less than ten per cent range.

Power factor correction

The basic supply for kilovars associated with substation loads is capacitors. Fixed units generally supply amounts up to or exceeding light load requirements. These are distributed as near to loads as feasible on primary distribution circuits.

Switched units supply from 50 to 100 per cent of the additional requirements above light loads associated with peak loads. Most of these are also located on distribution feeders with controls requiring minimum adjustment or change such as time clocks or thermostats.

Where substation transformers are not equipped with load tap changers, such as our older substations, and particularly those in fringe areas of the system or on low subtransmission supply, bus connected switched capacitors have proven effective both for kilovar supply and voltage regulation.

Controls for these are usually more sophisticated such as voltage, voltage compensated by current or time, current control, supervised manual, or manual control where operators are available.

Use of capacitors combined with regulators is an economical solution to regulation problems in most cases. Table No. 1 shows the distribution of capacitors on the Oklahoma Gas and Electric system.

Most modern substation equipment is quite reliable if given adequate maintenance, but substation designs must still recognize possibility of failure of various elements due to storms, lightning, manufacturing defects, etc. Provision must also be made for equipment outage for maintenance. Some of these methods of insuring service reliability are:

(1) Provision of transfer busses,

(Continued on page 116)

Trend shows that utilities are buying mobile substations and transformers

◆ A growing trend by electric utilities to buy mobile substations and mobile transformers is noted by General Electric's Power Transformer Dept., Pittsfield, Mass.

According to the company, over 300 mobiles have been purchased by utilities from all electrical manufacturers in the past 20 years. Fifty-five per cent of the total kva and 36 per cent of the units have been bought in the past three years alone, indicating a decided increase in the use of this equipment.

General Electric records also show that 55 per cent of the mobile units and 65 per cent of the kva shipped in the past year have been in the form of mobile transformers, rather than complete mobile substations.

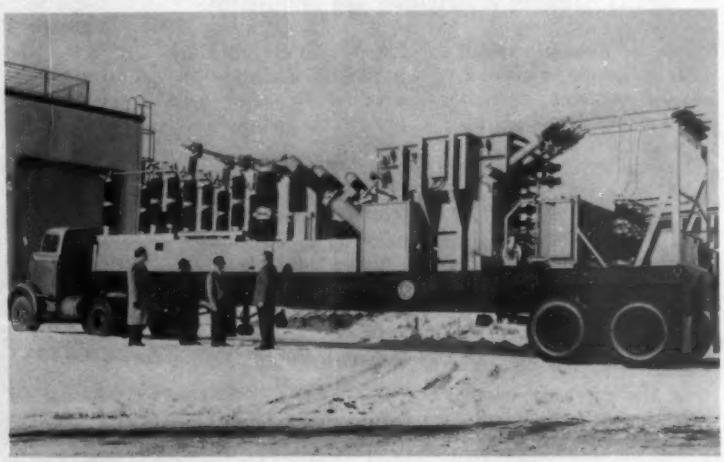
The figures were released by C. A. Shelton, General Electric sales manager, following the shipment of the company's millionth kva of mobile equipment — a 15,000-kva mobile substation to Virginia Electric Power Co.

Mr. Shelton sees several reasons for the growing utility use of mobiles. The most important is the availability of more and more kva per pound in mobile equipment which has answered a need for mobiles to service larger and higher voltage substations.

He cites the fact that nearly 60 per cent of all G-E mobiles shipped in the past year have been rated at over 7,500 kva. The company has shipped units rated 40,000 kva, 230 kv, and has the capability to go even higher and meet essentially the same weight limitations.

Utility purchasers realize savings in system investment by having one mobile service a number of substations, rather than locating spare equipment in each substation or in scattered locations.

Mobile equipment used in this manner can help restore service fast during temporary periods of emergency. They can also be used to carry a substantial load while maintenance and construction is being performed, permit careful scheduling of maintenance work, and carry loads while substations are being uprated or are being changed over.



Virginia Electric Power Company is recipient of the millionth kva of mobile equipment made by General Electric's Power Transformer Dept.

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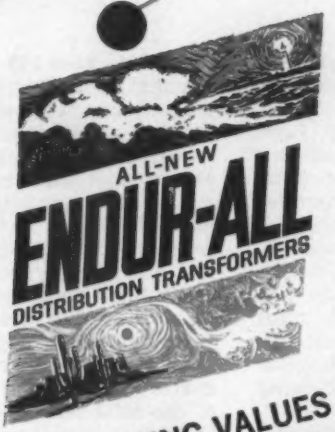

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Inadequate wiring in most homes

Industrywide action is necessary in view of surveys showing 80 per cent

By Clarence B. Grund, Jr., Southern Services, Inc., Birmingham, Ala.

◆ Several terms have been used by the electrical industry during the past few years in an effort to describe the inadequacies of residential service entrances.

"Service entrance bottleneck" and "inadequate wiring" are two such terms, but just what do they mean? In discussions with electrical contractors, electrical inspectors, and representatives of the utility industry, the following interpretations were given:

(1) Inadequate current-carrying capacity of the service entrance cable and panel.

(2) Inadequate circuit positions in the service panel.

(3) A lack of 240-volt appliance circuits installed when the house was constructed, resulting in expensive installation requirements which discourage the installation of electrical appliances.

The average residential customer load has been a fast-growing load with a steady increase each year and has not been severely affected by fluctuations in the economy. The residential load in 1959 represented about 27.6 per cent of the total kwhr sales, whereas in 1945 it represented about 17.7 per cent of the total sales.

The residential revenue in 1959 represented about 41.0 per cent of the total annual revenue from electric sales, whereas in 1945 it represented about 34.9 per cent.

The growth pattern of residential energy sales and revenue, as a per cent of the total energy sales and revenue, from 1945 through 1959, is shown in Figure 1.

Due to the growth since 1945, residential energy sales and revenue have taken a more important place in the shaping of the future of the electrical industry. The fact that the load is not severely affected by economic fluctuations adds to its importance.

From the data that has been shown, the question may arise as to why we, as an industry, should be concerned about the adequacies of the residential service entrance facilities.

In Figure 2, the national average annual kwhr use of the residential

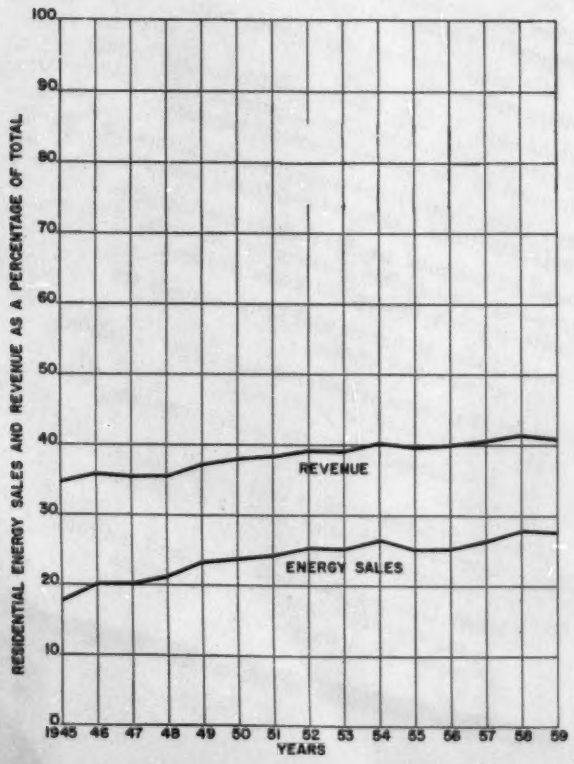

Fig. 1—This chart shows the growth pattern of residential energy sales and revenue as per cent of total.

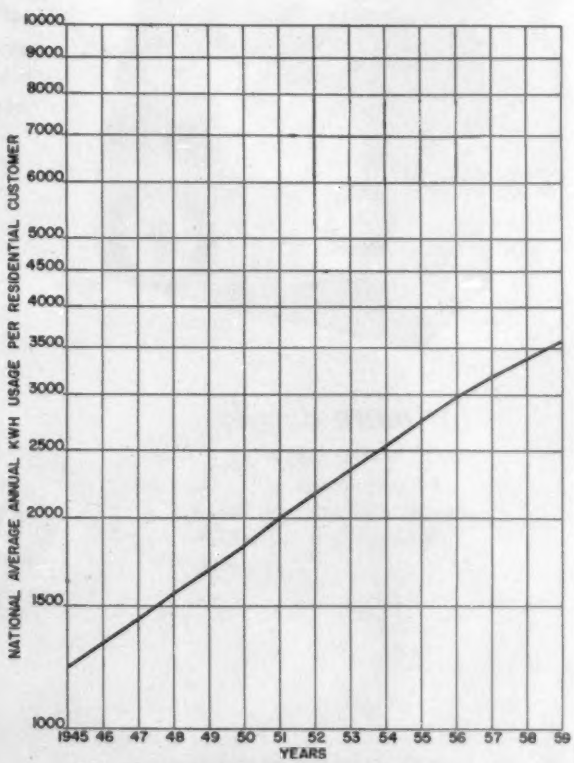

Fig. 2—From 1945 to 1959 the national average annual kwhr use of the residential customer grew 192 per cent.

deters greater use of electricity

of residential customers possess inadequate entrance equipment

customer is shown. In 1945 the use was 1,229 kwhr per year, and by 1959 the use was 3,585 kwhr per year—an increase of 192 per cent in the past 15 years.

A part of this increased use of electric energy has come from the new dwelling units which have been built since 1945, but a part of it also comes from those dwelling units built before 1945.

Some of the increase has come from greater use (a higher saturation) of the appliances which were on the market before 1945, but a major part of the increase has resulted from the use of appliances which have been developed and placed on the market since 1945.

Not only has the use of electrical appliances increased, but the wattage ratings of the appliances have increased. The result is that demand has been increasing at an even faster rate than use.

This increased demand is imposing a serious strain on the service entrance facilities, and the increased number of major appliances being used requires new circuits and circuit positions in the service entrance panel, all of which leads to the inadequate wiring which exists in many of the dwelling units in the nation today.

A few years ago a 60-ampere, three-wire service was considered adequate by the electrical industry. In most cases, the 60-ampere service was adequate for the load installed in the dwelling unit, but it did not allow for the addition of new appliances or the replacement of existing appliances with modern higher wattage units.

Also, the 60-ampere service entrance panel might consist of anything from four plug fuses to a deluxe panel with a main fuse block, a range fuse block, and six plug fuses.

With the deluxe 60-ampere panel, a home could be wired to serve a range and water heater and/or electric clothes dryer, along with the lighting and a few miscellaneous portable appliances.

However, in many cases (depending upon the living habits of the occupants) the main fuse was overloaded by the simultaneous use of two major appliances and normal use of lighting and miscellaneous appliances.

Higher service entrances

In 1959, both the FHA Minimum Property Standards and the National Electric Code basically required a 100-ampere service entrance whenever a range circuit was included in the wiring of a new dwelling unit. This was a step in the right direction, but a great many of the new homes being built still have a 60-ampere, three-wire service installed because the house is not initially wired for any major electrical appliances.

Also, it should be noted that both the FHA Minimum Property Standards and the 1959 National Electric Code are minimum standards and refer only to ampere rating, with no reference to availability of circuit positions. Therefore, a dwelling unit may be wired with a 100-ampere panel that contains only a main fuse block, a range fuse block, and four plug fuses.

This dwelling unit is now wired in accordance with the FHA Minimum Property Standards and the National Electric Code; but the occupant of the dwelling unit cannot add new major appliances other than the range without expensive rewiring to change out the existing service panel, or the addition of branch panels, even though the ampere rating of the service entrance equipment may be adequate.

The residential load is growing fast and it is an important load to all phases of the electrical industry. Therefore, we as an industry should do everything within our power to insure the continuance of such strong growth.

However, as new appliances are added, the reserve amperage capacity and the availability of circuit positions within the service entrance equipment is rapidly being used up, and rewiring of new and old dwelling units is becoming a major problem. In numerous cases, new service entrance facilities must be added before a new major appliance can be sold and the load of such an appliance can be added to the electric utility system.

Many times the sale of an electric appliance has been lost when the customer realized the expense associated with the proper installation of such an appliance, and the customer has either done without the appliance or purchased a similar appliance which could be operated by another means.

This loss has affected the entire electrical industry and was caused by the inadequacies of the service entrance facilities.

Figure 3 shows the number of residential customers served by the electrical industry from 1945 through 1959. Of some 49 million customers, it is estimated by various sources that some 80 per cent or more, approximately 39 million, have inadequate service entrance equipment which either prevents them from adding a major appliance without extensive rewiring or limits the use of presently installed appliances due to overloading of the service entrance facilities.

In approximately 25 per cent of the cases, a customer in an old dwelling unit can never install a 240-volt appliance because the service to the dwelling unit is 120-volt, two-wire.

Survey shows inadequacies

A recent survey of installations in new homes built by contractors in the Southeast presented some rather startling facts about the inadequacies that now exist, or will exist, in the service entrance equipment. The results of the survey, shown in Table 1, represent new residential dwelling units constructed within an electric utility's service area for the first eight months of 1959, with a total of 10,864 installations.

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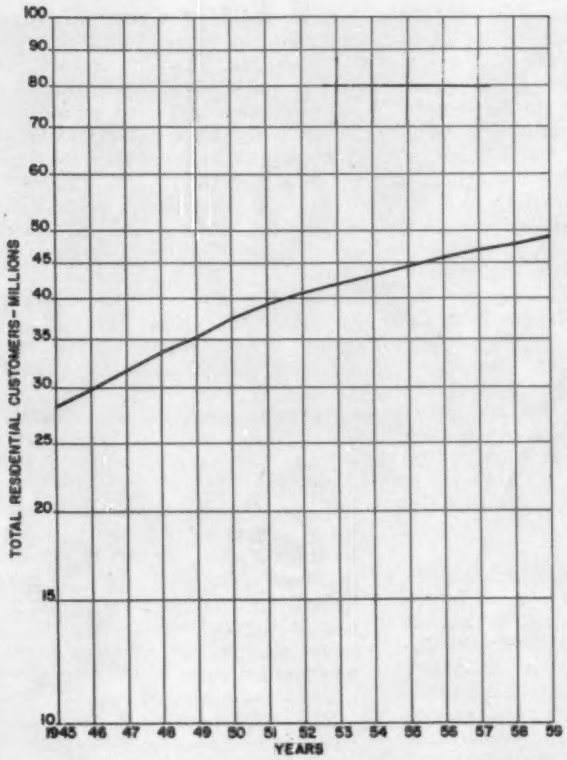
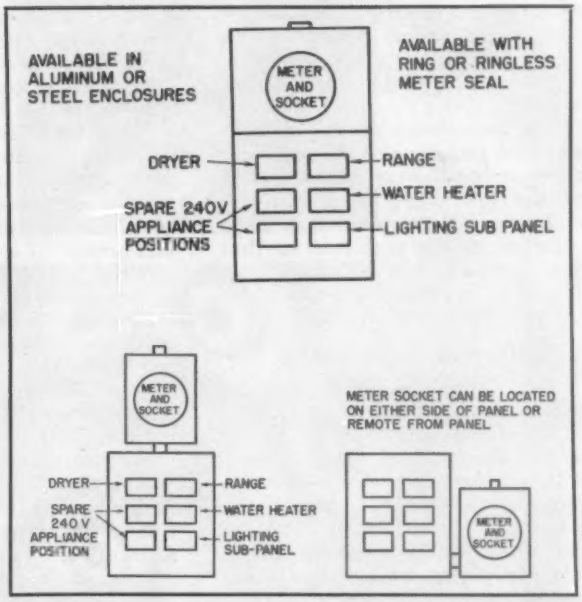


Fig. 3—This shows the number of residential customers served by the electrical industry from 1945 through 1959.



The desire to rewire will be increased if the cost and convenience to the customer can be held to a minimum. In most areas the existing service panel and connections thereto may be retained by installing an outside raintight main service entrance panel and then subfeeding the former panel. This may take the form of a combination meter-socket service entrance panel, top illustration, or a separate meter-socket and service entrance panel joined together by conduit or cable, bottom illustration.

Table 1 - New homes in the Southeast

Ampere Ratings of the Surveyed Installations - 10,864 Units	
Less than 100 Amperes	44.0%
100 Amperes	50.9%
Over 100 Amperes	5.1%
Double-Pole 240-volt Fuse Positions Available for Appliance Use in 100-Ampere Fuse Panels - 3,670 Units	
No Double-Pole Fuse Position	14.6%
1 Double-Pole Fuse Position	31.9%
2 Double-Pole Fuse Positions	28.9%
3 or more Double-Pole Fuse Positions	24.6%
Single-Pole 120-volt Fuse Positions Available in the 100-Ampere Fuse Panels - 3,670 Units	
6 Single-Pole Fuse Positions	33.5%
8 Single-Pole Fuse Positions	34.7%
12 Single-Pole Fuse Positions	20.5%
16 Single-Pole Fuse Positions	10.0%
20 Single-Pole Fuse Positions	1.3%
Equivalent Single-Pole Circuit Positions Available in the 100-Ampere Circuit Breaker Panel Installations - 1,860 Units	
8 Circuit Positions	56.1%
12 Circuit Positions	30.8%
16 Circuit Positions	5.7%
20 Circuit Positions	7.4%

Note: Two single-pole positions are required for each double-pole 240-volt position.

Even when 100-ampere installations or larger were being considered as the minimum, 44 per cent of the installations were less than 100 amperes. Of the 3,670 units of 100-ampere fusible service entrance equipment installed, 75 per cent of the installations had two or less 240-volt fuse pull-out positions for major appliances, and 68 per cent of the installations had eight or less 120-volt fuse plug positions.

Of the 1,860 units of 100-ampere circuit breaker type installations, 87 per cent of the installations had the equivalent of 12 single-pole positions or less, two of which are required for each 240-volt appliance connection.

Additional surveys were conducted in other electric utility areas and the results were basically the same in all categories, with variations of only two or three percentage points.

The results of this survey and the others indicate that the majority of the new residential dwelling units are being wired on the basis of an absolute minimum standard, thereby preventing the occupants of such dwelling units from taking advantage of even

basic major electrical appliances, such as a range, water heater, clothes dryer, etc., without being faced with a major expense for rewiring.

The importance of the residential load and some of the problems surrounding the continued growth of the load have been outlined, and now it is time to find some solution to the problems so that future growth may be achieved in the most economical manner for the residential customer.

Minimum requirements

First, let us consider some of the minimum requirements for an adequate service entrance installation. A dwelling unit of approximately 1,200 square feet should have a minimum of ten 120-volt, single-pole circuit positions to allow for full use of lighting and the portable appliances which are on the market today.

The 120-volt, single-pole circuit positions would be used as follows:

(1) At least two 20-ampere circuits for the first 500 square feet of floor area for outlets, except those in the kitchen, dining and laundry areas.

(2) At least one 20-ampere circuit for each additional 500 square feet, or fraction thereof, of floor area for outlets.

(3) At least two 15- or 20-ampere circuits for indoor and outdoor overhead lighting fixtures.

(4) At least two 20-ampere circuits for outlets in the kitchen and dining area.

(5) A 20-ampere circuit for an automatic washer, either installed or where space is provided.

(6) Provision for at least two future 20-ampere circuits to serve outlets.

(7) Individual circuits for each fixed appliance of 1,200 watts or more, whether installed or where space is provided.

The dwelling unit should also have a minimum of four 240-volt, double-pole circuit positions for the exclusive use of major appliances, which would permit the use of an electric range, electric water heater, electric dryer, air conditioning, and partial electric space heating, or any combination thereof, without having to replace the service entrance panel.

Therefore, a minimum size service entrance panel, which should be installed in all new dwelling units of approximately 1,200 square feet, should contain four 240-volt, double-pole circuit positions for the exclusive use of appliances and ten 120-volt, single-pole circuit positions for lighting and outlets, and should be of at least 100-ampere rating.

On new construction, the problem might be said to be simple: all that we as an industry have to do is to convince the builder of new dwelling units that such a service entrance installation, as previously outlined, is necessary and proper.

With foresighted builders, some progress can be made because the incremental cost of providing the additional ampere or circuit capacity required is a very small part of the cost of the total electrical job. Wherever possible, the builder should be encouraged to run the appliance circuits to the proper location or install the panel in such a way as to make the installation of heavy appliances easier at a later date.

This whole problem is a matter of education, and we as an industry must take the attitude that we must look to and sell for the future use of electrical appliances.

We must also educate the occupant of the dwelling unit, and in terms which he can understand.

One approach is the continued use of engineering terms such as ampere ratings and wattage, but another very effective approach may be in terms of circuit positions and their use. Circuit positions are a tangible item that can be counted and associated with appliances.

Now, the problem is what to do about the builders who will not install sufficient capacity or circuit positions to take care of the future, and what to do about the some 39 million or more dwelling units that are already inadequate and whose owners may desire to install new appliances and new service entrance equipment.

The sale of appliances and the desire to rewire will be increased if the cost and inconvenience to the customer can be held to a minimum.

Utilize existing equipment

This can be accomplished by installing equipment which permits the maximum utilization of the existing equipment. For example, in most areas the existing service entrance panel and connections thereto may be retained by installing an outside rain-tight main service entrance panel and then subfeeding the former panel.

This outside service entrance panel may take the form of a combination meter socket service entrance panel or a separate meter-socket and service entrance panel joined together by conduit or cable.

The latter type of installation offers more flexibility in the location of the meter and panel, and it permits the electric utility to furnish the meter-socket in those areas where that is the practice.

Since the National Electric Code allows up to six means of disconnect, and since most local codes conform to the National Electric Code, the most economical and practical outside service entrance panel is one which contains six 240-volt, double-pole circuit positions.

In some areas the electrical inspector may require a main disconnect but, even so, only 240-volt circuits should originate within the outside service entrance panel. In some instances where the local electrical code required a main disconnect, the electrical inspectors helped to change local codes to permit the outside installation to have six means of disconnect, whereas an inside installation must have a main disconnect.

The consensus was that the dwelling unit was electrically safer with the outside installation because all circuits which enter the dwelling are fully protected and cannot be overloaded.

Many questions have been asked about the use of outside service entrance panels. Can an exterior panel be attractive? Yes, it can.

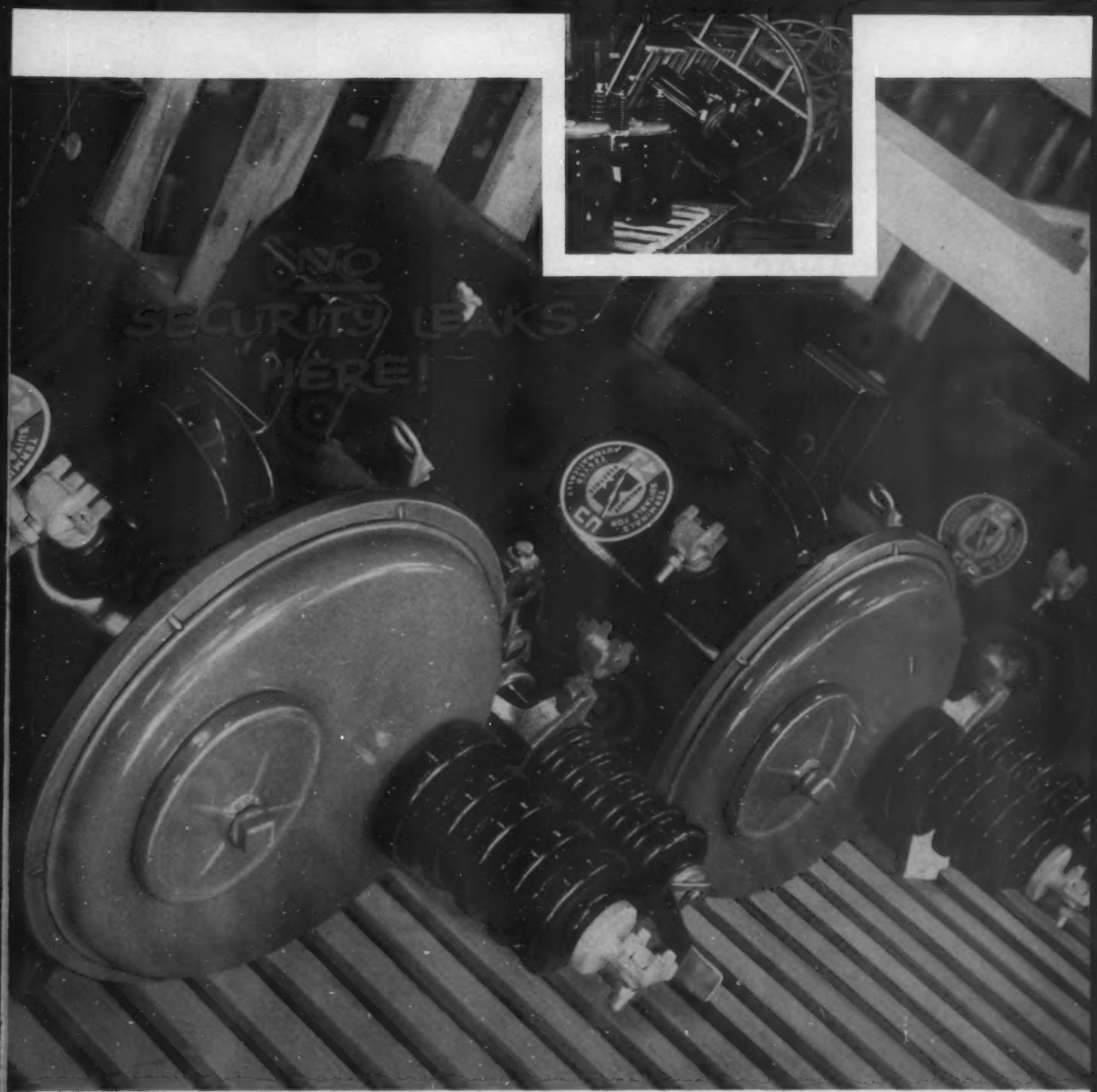
What about resetting of breakers or replacing fuses? Most circuit problems occur because of faulty extension cords, etc. These faults seldom, if ever, trip the 240-volt circuit breakers. Main power circuits (240-volt) seldom blow or trip and, when they do, an electrician is generally called to correct the trouble.

Since it is recommended that lighting and small appliance load centers be located within the dwelling unit, the problem of resetting breakers or replacing fuses is minimized. Also, past experience with exterior panels has not presented any serious problem such as children turning off the power, vandalism, etc.

Exterior residential entrance panels have been used in large numbers for several years in Arizona, Texas, California, North Carolina, Kentucky, and other areas, and more recently in Alabama and Mississippi.

The installation cost of an outside service entrance panel on an existing dwelling unit has been found to be more economical than

(Continued on page 116)



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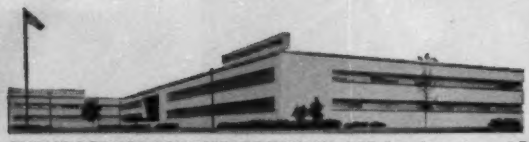

PUBLIC SERVICE COMPANY OF INDIANA, INC. headquarters at Plainfield

THOUSANDS OF FISHER-PIERCE CONTROLS HAVE FOUND A HOME IN INDIANA

Model 6600A photoelectric controls are a familiar sight in the area served by Public Service Company of Indiana, Inc., as these photos show. "Just plain economics" is the way one Company official explains the trend to multiple individual control. Installation costs are lower. Maintenance is less of a problem, too — reliable Fisher-Pierce controls more than pay their way by eliminating frequent repair calls.

Multiple individual control fits into the PSCI voltage conversion program by eliminating the need for expensive series circuits, taller poles and additional arms for street lighting. The method pays dividends in customer satisfaction, too. Residents are assured of dependable street light operation, and neighborhood appearance is improved by uncluttered poles. Storm outages cause less concern since entire streets are not always plunged into darkness at a stroke. Outages are generally shorter in duration — street lights, supplied from secondary lines, can be returned to service as soon as residential service is restored.

STREET LIGHTING in Plainfield housing development is all Fisher-Pierce controlled.

All photos courtesy of Public Service Company of Indiana, Inc.

NEWEST PUBLIC SERVICE COMPANY generating facility is the Robert A. Gallagher Station, recently completed. System generating capability has grown to 1.6 million kilowatts, more than a four-fold increase since 1948.

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Meeting covers all facets of poles

Several presentations discuss maintenance, inspection, and treatment

◆ Virtually all facets of wood utility poles were covered at the recent South Atlantic Wood Pole Conference held at North Carolina State College, Raleigh.

Leon J. Jacobi, first vice-president of the American Wood Preservers Association and associated with the Detroit Edison Company in Detroit, delivered the keynote address.

Topics presented included forest tree breeding for better poles, deterioration by decay fungi, the production of wood poles, pole specifications and purchases, and a possible cooperative college and industry training program for pole inspection and maintenance personnel.

Of particular interest to pole-conscious utility personnel were three talks discussing various maintenance, inspection, and treatment procedures for wood poles.

A. H. Hearne, an engineer with the American Telephone and Telegraph Co., N. Y., presented, "Maintenance Inspection of Wood Pole Lines."

Mr. Hearne declared, "Because a man has worked on poles for a number of years does not make him a qualified pole line inspector."

According to him, pole line inspection too often is used as a "make work" item during slack times or is assigned to older linemen who are no longer capable of performing their former duties. Unless these people are properly trained the results of their inspection can be costly because either they leave poles in line which may fail at an early date or condemn poles which have several years of useful life remaining.

"Pole line inspection is a specialized job and the importance of adequate training of inspectors cannot be overemphasized," he remarked.

In the past, the age when an initial inspection of a pole should be made depended upon the resistance to decay and insect attack of the species of pole timber involved. This in turn depended largely upon whether the pole was given a preservative treatment before installation and upon the type of such treatment.

At present, practically all poles going into plant are treated full length either by a pressure process or by the thermal (hot and cold bath) process. The specified retentions of preservative vary for the different species but are based on the relative sapwood thickness so that retentions in the treated wood are essentially equivalent.

Requirements for the depth of penetration of the preservative also vary for the different species of pole timbers depending on their sapwood thickness, but are such that protection of the sapwood is essentially equivalent for all species.

Mr. Hearn continued, "It has been observed that the incidence of early failures and the rate of deterioration varies with geographical location due to variations in climatological factors. The two climatological factors which appear to be most closely correlated with the performance of poles in line are average rainfall and the length of the growing season."

He listed four factors which influence the scheduling of periodic reinspections, namely:

(1) Climatic conditions in the area in which the poles are located.

(2) Avoidance of too frequent coverage of the pole replacement forces as the result of inspection intervals which are too short.

(3) Sacrifice of useful life resulting from inspection periods which are too long.

(4) Cost of inspection.

Wood deterioration

"The major cause of deterioration of wood in use," he stated, "is decay or rot. Decay is caused by low forms of plant life called fungi. The vegetative stage of fungi consists of minute threads which grow within the cells of the wood.

"These secrete enzymes which break the wood substance down into compounds which can be used by the fungi for food. The toadstools or brackets often found on decayed material are the fruiting bodies in which spores or seeds are produced."

There are three types of decay found in poles. Internal decay, called "hollow heart" by pole inspectors, in the deep sapwood species such as southern pine, ponderosa pine, and red pine, is usually found in untreated sapwood because of poor or irregular penetration of the preservative.

External decay, usually called "rotten butt" by pole inspectors, is found at or below ground line. The distance below ground line at which it is most severe varies with soil moisture conditions and type of soil.

Shell rot, usually found in butt-treated cedar poles, is confined to the sapwood in the aerial section. It is generally found under a paper-thin shell of sound wood too dry to decay.

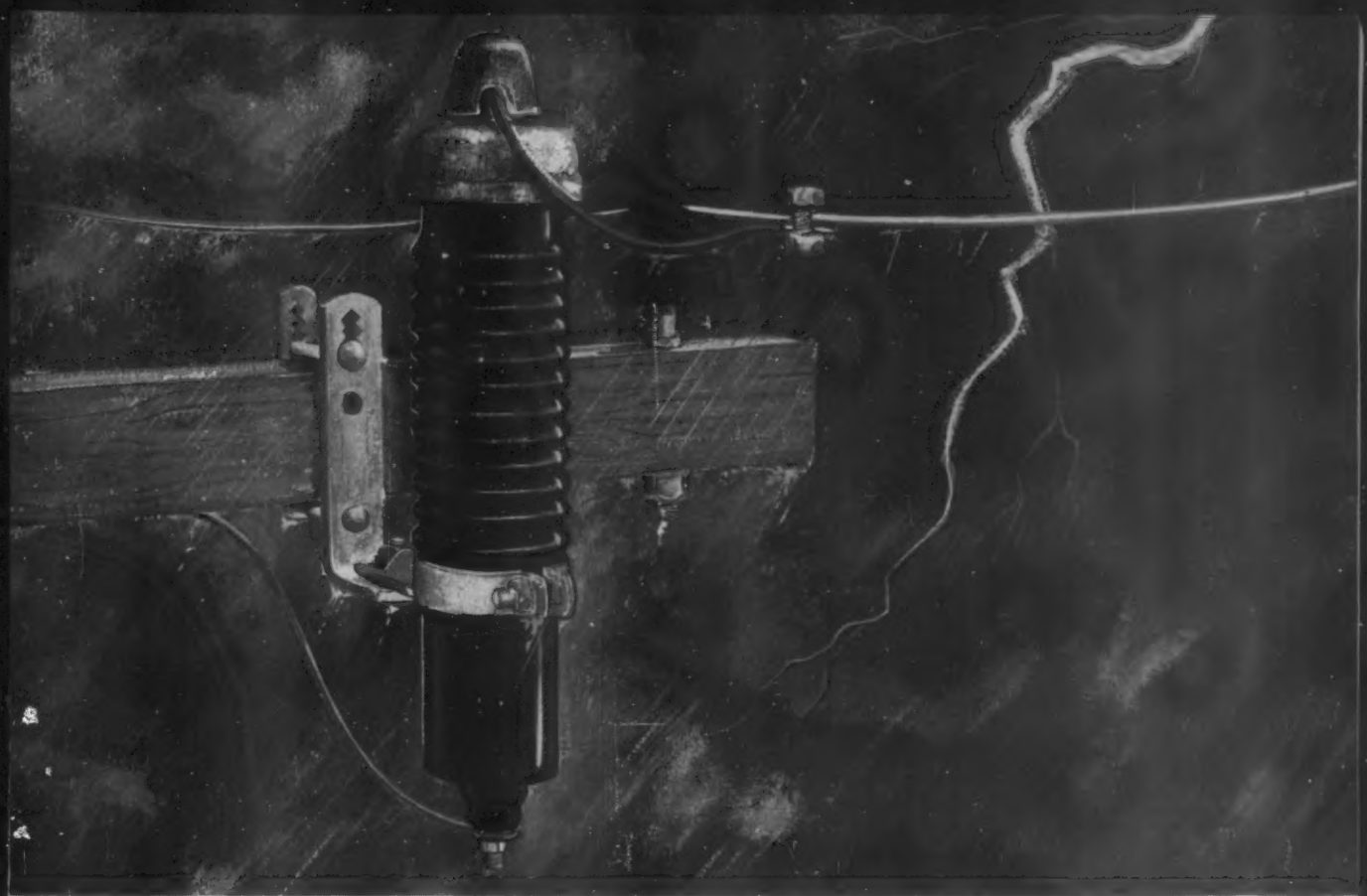
Other causes of damage

The most common type of insect damage found in poles is caused by termites. Termites are of two types—the subterranean type, which has been found in all of the original 48 states, and an aerial type, found in southern Florida and in southern Arizona, New Mexico, and California.

"There have been a number of theories advanced to explain why woodpeckers attack poles. Unless there are insects present, such as carpenter ants or bees, or the woodpecker wishes to build a nest, most of the theories have proven fallacious."

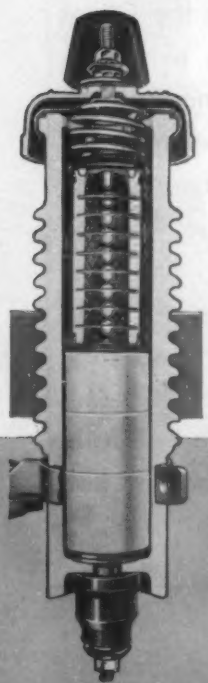
Compression wood is very dense wood, high in compressive strength but weak in bending, resulting from an unbalanced load on a growing tree caused by, for example, prevailing wind pressure or a large limb on one side of a tree.

Because the longitudinal shrinkage of compression wood is greater than that of normal wood, the



THE TYPE E5 DISTRIBUTION ARRESTER. Compact, efficient, with better electrical characteristics. Excellent long-life protection. Also available in externally gapped (T5) design. Ask the L-M Field Engineer for details, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.

L-M Offers Concept Of Total System Protection With New Type E5 Arrester



New distribution arrester design with high-intensity copperized valve blocks provides low sparkover and low discharge voltage; retains excellent thermal and follow-current characteristics.

Adequate lightning protection consists of low sparkover and discharge voltage, for safe margin; high thermal capacity, for long life; low follow current, for minimum system disturbance; and universal system application, unlimited by available 60 cycle fault current magnitudes.

None of these factors can be considered separately. All apply equally. This, then, is the total concept of lightning protection which Line Material introduces in its Type E5 distribution arrester. Thus, when you buy the Type E5 arrester, you get balanced, lasting protection resulting in low total costs.

CUTAWAY VIEW OF THE E5 (T5 internal construction is similar) shows the long-life ladder gap, valve element of copperized, ceramic-coated silicon carbide blocks that provides low sparkover, high discharge capacity, fast response, with outstanding current limiting characteristics. Be sure to ask your L-M Field Engineer for more information.

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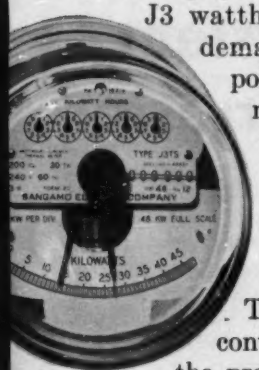

These new meters are compact and use conventional round covers. They retain the proven advantages of previous Lincoln demand meters: independent watt demand and watthour measurement, dual range, sectionalized construction, and interchangeability.

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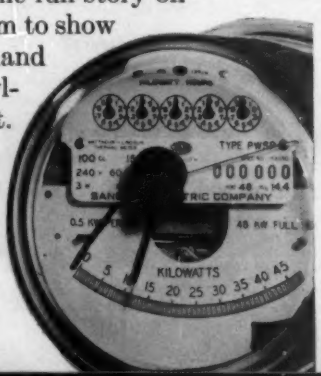

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CHAFING DAMAGE?

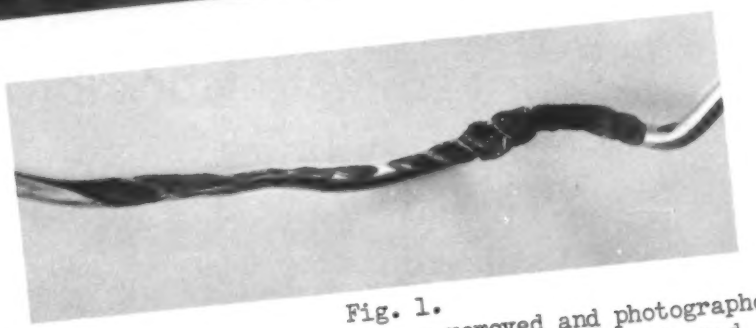


Fig. 1.
This badly abraded tie wire was removed and photographed during an inspection of the tie points on an undamped distribution line in a northwestern state. The line (1/0 ACSR - 6/1) was constructed in the Spring of 1959 and the utility made an inspection 17 months later. The damage was attributed entirely to Aeolian vibration.

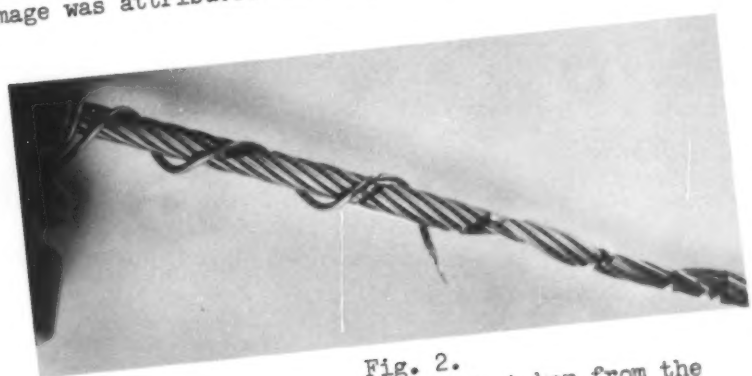
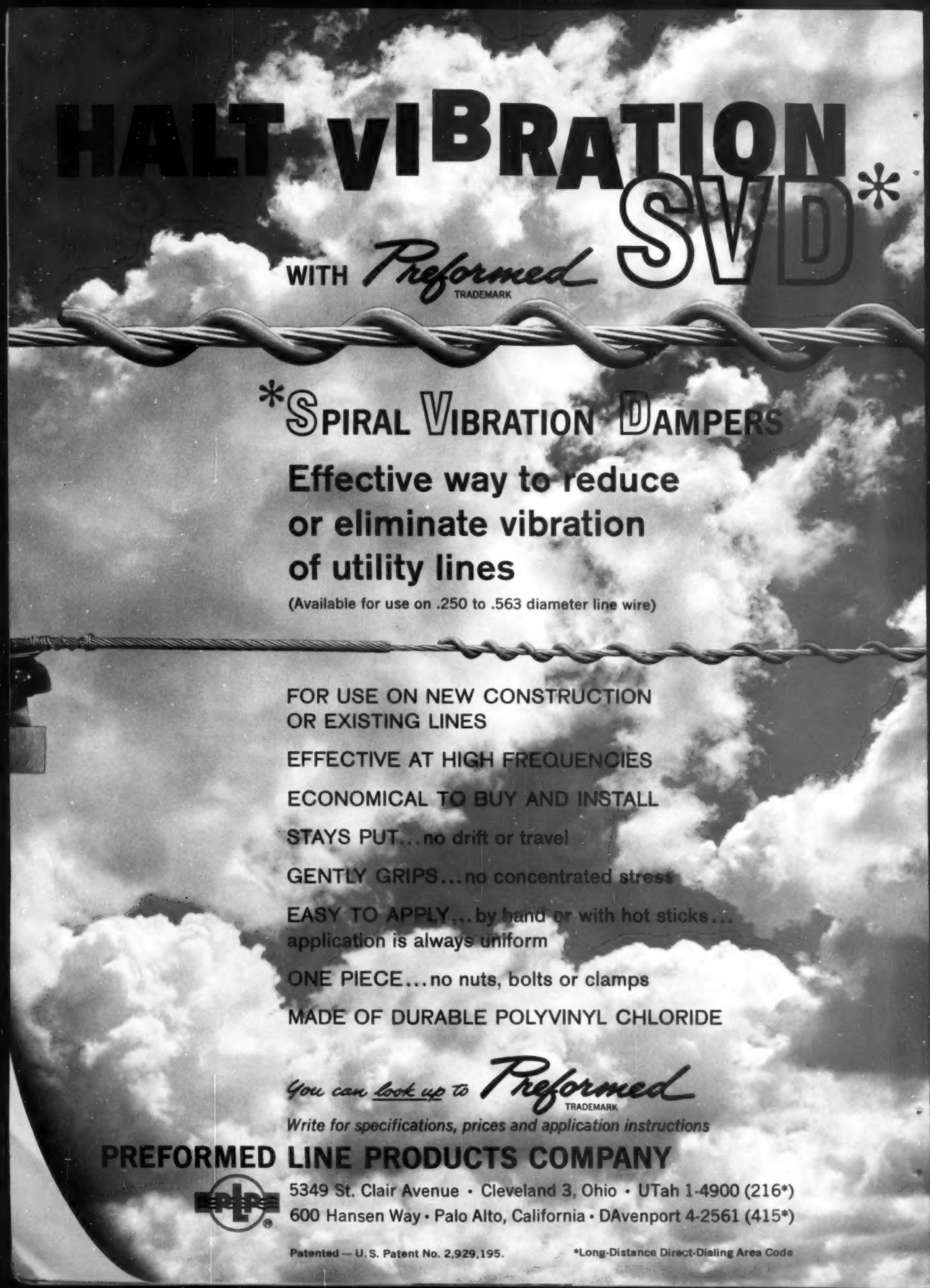


Fig. 2.
Deep gashes in the armor rod, taken from the same line, illustrates the excessive chafing damage resulting from Aeolian vibration on undamped lines in locations where wind, temperature, and terrain are conducive to sustained vibration. Without protective armor rods at the tie points, this damage would have occurred to the conductor.

See other side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stresses set up during drying cause the compression wood to crack longitudinally. Compression wood is a safety hazard to a man climbing.

"Mechanical damage may be caused by lightning, split tops, road-grading or farm machinery, snow plows, automobiles, trucks, or even by young George Washingtons trying out their new hatchets. Lightning may remove a shallow slab from or may split or shatter the top of a pole."

Splits in the top are the result of expansion and contraction because of moisture changes. As a rule they are not serious unless in a plane which will loosen through bolts or other hardware. They may, however, expose untreated wood to decay.

Road-grading equipment, farm machinery, and snow plows may gouge out the lower part of poles, often sufficiently to impair their strength seriously. Poles hooked by car or truck bumpers, particularly at filling stations or loading platforms or in alleys, may be seriously damaged. Poles hit by motor vehicles may appear undamaged on casual inspection but may be cracked in the upper part as a result of the impact.

If so, these poles are a serious safety hazard as they may break later under an unusually low load such as may be imposed by a man working on them.

A complete inspection of a pole would include, in addition to the inspection of the poles and crossarms, the inspection of all attachments to the pole.

After inspection

When a pole has been inspected and found in a decaying condition, should it be condemned or is there enough sound wood left to support the imposed load and should it be left in line until at least the next inspection period?

"This decision," he said, "is usually based on the adequacy of the residual sound wood at the point of greatest decay, generally in the ground line section, to support the load on the pole under storm loading conditions and taking into account the fiber stress of the species of pole timber and the safety factor for the class or grade of the line."

For practical purposes tables may be made up showing minimum required circumference for each class or grade of line and for each species of timber based on the storm load on the wires, cables, and other attachments on the pole; the distance from center of load to ground line; and span length. Tables can also be made to show deductions in circumference for different types of decay.

Mr. Hearn pointed out that in poles having external decay below ground line around the entire circumference, the decay may be scraped away and the residual circumference measured or deductions, based on the average depth of decay, made from the measured circumference above the decay.

Maintenance program

The subject presented by Walter J. O'Neal, a timber specialist with the Rural Electrification Administration in Washington, D. C., was "Maintenance Program for Poles in Service."

He began by stating that prior to 1950, Rural Electrification Administration borrowers had experienced few pole failures.

"Since construction of the first lines began in 1935, few were to be expected as the oldest had been set only around 15 years. Of course there were a few weak sisters which we expect to find in almost any group of treated wood poles.

"In the early part of 1950, however, we were suddenly confronted with a veritable deluge of complaints saying poles were falling down because of groundline decay. A vast majority of these complaints concerned poles that had been treated with substitutes or alternates which were authorized during the post World War II period of preservative shortage.

"Some of the failures reported had been in service only a very short time—in fact, in some instances we felt the failed poles would actually have lasted longer had they been installed untreated. Subsequent investigations made at numerous points throughout the country revealed a rather clear pattern of decay conditions which we could anticipate finding in poles treated with the alternates.

"We were surprised to discover that certain of our so-called well treated (i.e., with standard preservatives) poles were showing signs of fungal decay infection and/or insect infestation or attack. We learned too that a few borrowers had incurred failures in a more or less limited degree from these causes.

"Most of the decay we discovered was on the surface of the pole and could be found from ground level down to 18 inches or two feet below, depending principally on soil type and ground moisture conditions. Exceptions were found where penetration was shallow, or bird damage, checks, or injury caused openings extending beyond the depth of treatment. In such cases internal decay was frequently found in untreated sapwood and in the heartwood, too, of some species."

On the other hand, internal decay was the rule rather than the exception when poles had been treated with one of the substitutes.

In view of the findings, it was felt to be imperative that instructions covering the inspection and maintenance of wood poles in line be issued. Stimulating efforts toward that end were reports of property damage, excessive line outages, stock killed, and above all loss of human life due to pole falling accidents. Most of these accidents were caused by poles treated with substitutes.

Experience had shown there was no shortcut method which could be used to inspect poles in place in an accurate appraisal of their physical condition. It had to be a thorough, conscientious job of digging out the groundline area, testing with a hammer, probing the surface for soft spots, and sampling the interior with an increment borer.

"We in REA feel that the principal benefit to be realized from a wood pole maintenance program is knowledge of the physical condition of poles in the system," said Mr. O'Neal.

"We suggest that wood poles users in . . . North Carolina and neighboring states give serious consideration to starting a systematic ground line maintenance program when poles reach the age of ten to 12 years.

"Information obtained by our rather comprehensive 'Materials and Equipment Performance Survey' shows that approximately 1.5 per cent of our southern pine poles, pressure treated with eight pounds of good preservative, are removed because of failure from decay when that age bracket is reached in this locality.

"It naturally follows that a much higher percentage will no doubt be in a deteriorating stage somewhere between sound and failed."

Economic considerations

"Economic Considerations in Pole Maintenance and Replacement," was the subject of a presentation made by Daniel A. Campbell, Jr., general superintend-

(Continued on page 116)

CHANCE CLAMPS

ARE DESIGNED WITH CONDUCTOR IN MIND

there's a Chance clamp for every conductor material... every conductor size

First step in making a good line connection is to select the *right* clamp for the type connection to be made. You'll find the clamp you need for copper to copper, aluminum to aluminum and general purpose connections in the complete Chance line.

Chance is the world's largest producer of hot line clamps. Chance clamp engineers have developed such innovations as T-type terminals, aluminum body clamps, compensation for line vibration, and control deflection of the eyescrew.

Chance clamps are available individually packaged in plastic bags with Chance z.l.n. 100 Contact Aid already applied.

A.B. CHANCE CO.
CENTRALIA, MISSOURI
(A. B. Chance Company of Canada, Ltd. Toronto)

CC61-138

New utility equipment

Preformed vibration damper

A vibration damper designed specifically for small-diameter electrical distribution lines has recently been developed by Preformed Line Products Co., 5349 St. Clair Ave., Cleveland 3, Ohio, and is currently available for conductors ranging in size from No. 4 to 4/0.

Purpose of the Preformed spiral vibration damper (SVD) is to arrest Aeolian vibration, the primary cause of chafing damage to tie wires, armor rods, and conductors, particularly in wide-open areas where the wind velocity is both mild and constant and where long spans and high tensions exist.

The new damper, which effectively controls vibration—even at high frequencies — is recommended on spans where it is necessary to correct existing undamped lines or on new

construction in areas where vibration is known to be a threat to suspension points.

Arresting of vibration is achieved through the "free response" principle. Thus, a one-piece, helical spiral with the weight evenly distributed over a wide area is sufficient for effective damping performance.

No clamping mechanism is required to secure the Preformed damper and there are no parts to shake loose. A "pigtail" with a reduced inside diameter at the insulator end gently grips the conductor and prevents travel of the damper from the installed position, even on downhill spans.

Write U-601 on reply card, pg. 19

Westinghouse outdoor cutout

A new line of distribution cutouts (LBU) from Westinghouse Electric Corp., P. O. Box 2278, Pittsburgh 30, Pa., has a built-in load break.

The same new cutout is also available without the load break (LDX).

The load break can operate repeatedly for the life of the cutout without maintenance or replacement of parts. Also, it requires no special

tools and is safe for linemen to operate with an ordinary hookstick without danger of flash burns.

Load current is normally carried through the main contacts and the fuse link. In parallel with these are a quick-break blade and another pair of contacts located with an arc chute.

As the hook eye is pulled, the main contacts unlatch after closing the other quick break contacts. With current now through the blade, the operator continues to open the cutout, cocking the blade against a coil spring.

When the main contacts are open to a point where they cannot restrike, the blade snaps open, drawing an arc through the deionizing chute.

The arc chute is constructed of a new deionizing thermoplastic material, Delrin acetal resin, used for its electrical, physical, and weathering qualities.

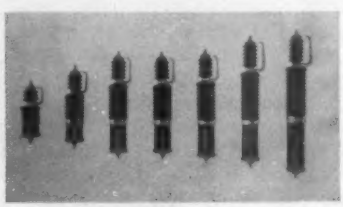
Write U-602 on reply card, pg. 19

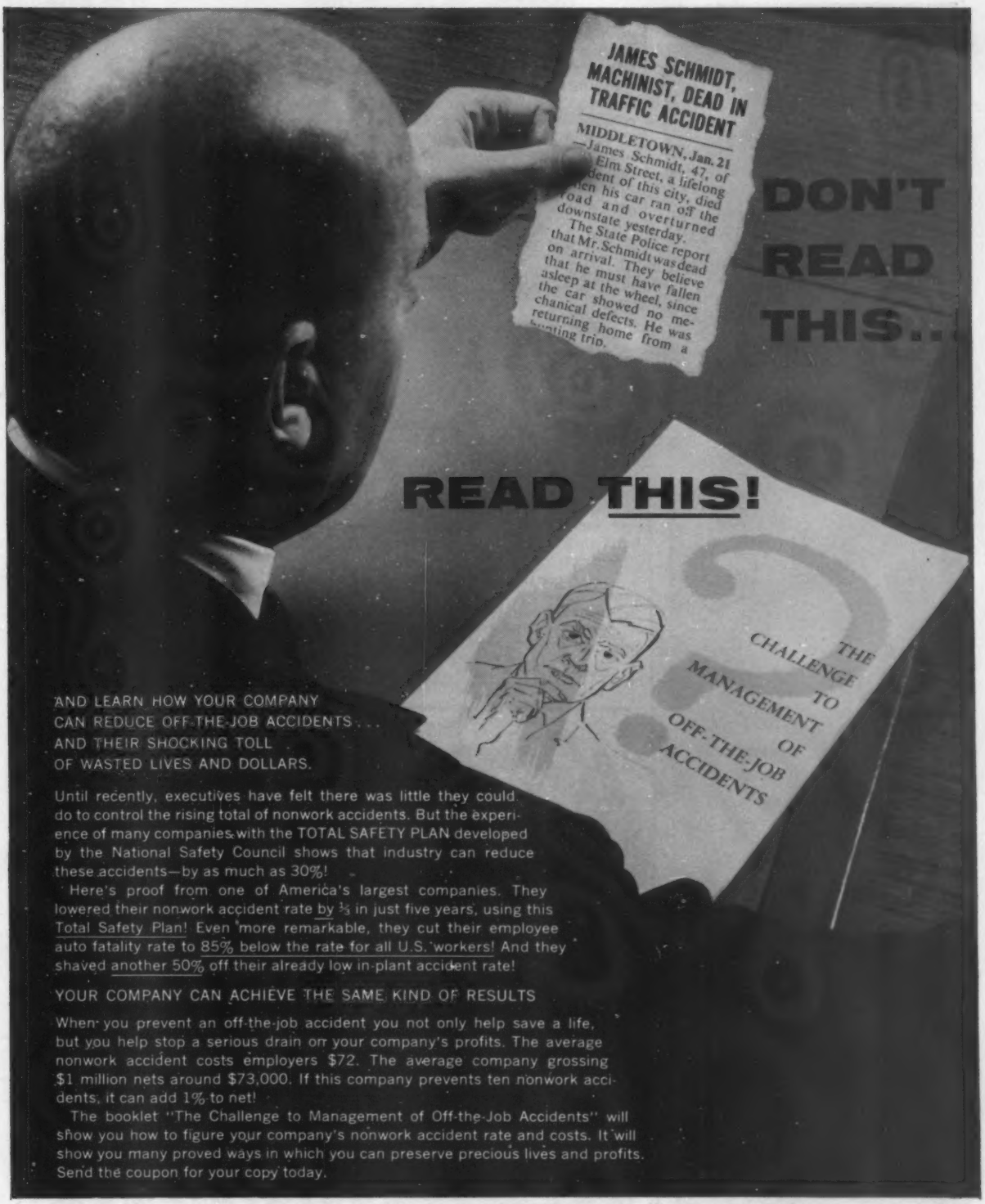
L-M lightning arresters

Completely new lines of distribution class, valve type, lightning arresters that afford significant improvement in apparatus protection are available from Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis.

These arresters, designated type E5 direct connected and T5 externally gapped, are manufactured in standard voltage ratings of one through 20 kv.

L-M's new arresters combine com-




JAMES SCHMIDT, MACHINIST, DEAD IN TRAFFIC ACCIDENT
MIDDLETOWN, Jan. 21 —James Schmidt, 47, of Elm Street, a lifelong dent of this city, died hen his car ran off the oad and overturned downstate yesterday.
The State Police report that Mr. Schmidt was dead on arrival. They believe that he must have fallen asleep at the wheel, since the car showed no mechanical defects. He was returning home from a hunting trip.
DON'T READ THIS...
READ THIS!
THE CHALLENGE TO MANAGEMENT OF OFF-THE-JOB ACCIDENTS

AND LEARN HOW YOUR COMPANY
CAN REDUCE OFF-THE-JOB ACCIDENTS . . .
AND THEIR SHOCKING TOLL
OF WASTED LIVES AND DOLLARS.

Until recently, executives have felt there was little they could do to control the rising total of nonwork accidents. But the experience of many companies with the TOTAL SAFETY PLAN developed by the National Safety Council shows that industry can reduce these accidents—by as much as 30%!

Here's proof from one of America's largest companies. They lowered their nonwork accident rate by ⅓ in just five years, using this Total Safety Plan! Even more remarkable, they cut their employee auto fatality rate to 85% below the rate for all U.S. workers! And they shaved another 50% off their already low in-plant accident rate!

YOUR COMPANY CAN ACHIEVE THE SAME KIND OF RESULTS

When you prevent an off-the-job accident you not only help save a life, but you help stop a serious drain on your company's profits. The average nonwork accident costs employers $72. The average company grossing $1 million nets around $73,000. If this company prevents ten nonwork accidents, it can add 1% to net!

The booklet "The Challenge to Management of Off-the-Job Accidents" will show you how to figure your company's nonwork accident rate and costs. It will show you many proved ways in which you can preserve precious lives and profits. Send the coupon for your copy today.

Published to save lives in cooperation with The Advertising Council and the National Safety Council

SUPPORT YOUR LOCAL SAFETY ORGANIZATION

NATIONAL SAFETY COUNCIL
425 NORTH MICHIGAN AVENUE
CHICAGO 11, ILLINOIS

Please send a copy of "The Challenge to Management of Off-the-Job Accidents." I want to learn how my company can save lives and dollars with your TOTAL SAFETY PLAN.

NAME_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

For more details on above items, use reply card on page 19

Precision automated lighting

cuts cost
accidents
security risks

One user bought two Precision controls for $35 — saves 3000 watt hours of power monthly. Other users cut pilferage and accidents to zero.

Installed in minutes, field-proven Precision photocontrol turns lights on at sunset — off at sunrise automatically. Needs no maintenance, pays for itself because lights are on only when needed.

Write — wire for details.

PRECISION
MULTIPLE CONTROLS, INC.
Ridgewood, New Jersey, U.S.A.

The difference between night and day

pactness and simplicity of design with improved discharge-voltage and sparkover characteristics without sacrifice of proved life expectancy. Outstanding features of L-M's new arresters are (1) stable and consistent sparkover characteristics, (2) low discharge voltage characteristics, and (3) compact size and rugged construction.

Porcelain housings afford long creepage distances that permit assembling improved gap and valve components into a short, lightweight unit.

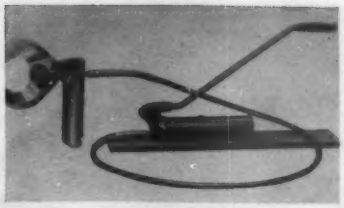
Permanent moisture-proof seals prevent internal contamination and radio interference.

Write U-603 on reply card, pg. 19

Porter cable cutter

Communications and utility companies who have to frequently cut copper and aluminum cable, where an outside power source is not available and where old-fashioned cutting methods are too slow, costly, and dangerous, can save time, man-hours, and money by the use of the new hand-hydraulic cable cutter from H. K. Porter, Inc., Somerville 43, Mass.

Two models provide quick, easy, positive cutting of copper and aluminum communication cable (not ACSR) up to three inches in diameter.



Field tests proved that these cutters are faster and safer than most present methods to cut underground, on the job, and in the warehouse for repairs, new installations, and salvaging cable.

The remote-control pump can be operated at street level while a cut is being made underground. The compact cutterhead reduces danger in confined areas.

Passing jaws give complete shear action and minimize crushing cable and inside wires. Cutting blades are drop-forged and induction-hardened to give long service. A simple adjustment can be made to the ram to compensate for wear on cutting blades.

Write U-604 on reply card, pg. 19

G-E Locke post insulators

Completely new Locke line post insulators featuring extra-wide wire grooves to accommodate large conduc-

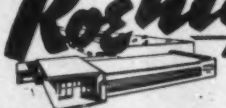
Koenig ALL-STEEL UTILITY BODIES

LINE-CONSTRUCTION BODY
. . . available in 9' to 14'6" lengths with mechanical or hydraulic winch and derrick, or any other special or custom equipment desired. Compartments can be arranged to your specifications.

SERVICE BODIES
. . . for ½-, ¾-, and 1-ton chassis. Electrically welded into one unit with six waterproof compartments, recessed paddle handles keyed alike and fender skirt protected with die-formed rolled edges. Built for safe, dependable service . . . will outlast several chassis.

SIDE BOXES
For all pick-up trucks, including the new compacts. Watertight compartments . . . double panel doors . . . recessed paddle handles with cylinder locks keyed alike. Eleven types, seven lengths available.

YOU CAN BE SURE OF QUALITY MATERIALS AND WORKMANSHIP WHEN YOU SPECIFY KOENIG PRODUCTS
Write for literature and specific information today.



Koenig IRON WORKS, Inc.
P. O. BOX 7726
DEPT. B
HOUSTON 7, TEXAS

tors of the future have been announced by General Electric's Insulator Dept., Baltimore, Md.

Available in five ASA sizes from 23 kv through 69 kv, the new insulators feature an extra-wide 1-3/4-inch wire groove to accommodate large aluminum conductors. Grooves have circular depths ranging from 5/8 inch in the lowest rating to 3/4 inch in all other ratings.

The new insulators have a rated cantilever strength of 2,800 pounds and an impact strength substantially higher than other similar units. Units tested at twice their cantilever rating produced no breakage in the porcelain.

The new insulators feature an exclusive metal disc which makes the insulator seal airtight to prevent moisture from entering the porcelain column.

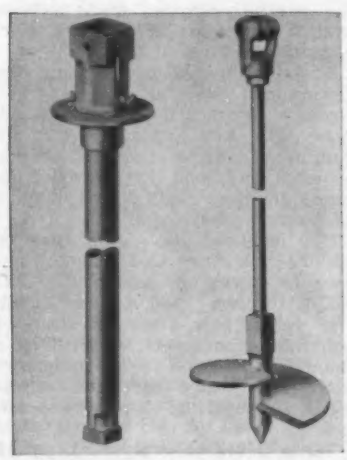
Incorporation of the metal disc in the new insulator units eliminates the conventional rubber diaphragms which tend to wrinkle and deteriorate, causing damage through air leakage.

Write U-605 on reply card, pg. 19

Hubbard screw anchors

A new line of screw anchors, called Power Drive and available from Hubbard and Co., Box 61, Lyons, Ill., can be installed with a power digger in a few minutes.

They are said to provide more positive holding power due to min-



Why are owners so enthusiastic about the DAVIS T-66 TRENCHER-BACKFILLER?

Because it outperforms any other trencher in its class and does its own *BACKFILLING* to boot!

Enthusiasm is the result of profits... and that's what the T-66 produces. It not only digs with amazing efficiency in the toughest soil conditions... but finishes up where others leave off—by backfilling. Ground-gripping traction for accurate ditching control and backfilling power is attained by large track shoes, a unique hydraulic drive, and the T-66's extra-heavy 1400-lb. weight. No erratic rubber-tire bounce. Hydraulically controlled boom lets you govern digging depth and handle the backfill blade with ease. Digs 4″ wide, **66″ deep** or **12″ wide**, 30″ deep and at varying widths and depths in between.

Special Attachments for 16″ Trenches and Flush Digging

These special attachments open the door for jobs previously reserved for larger, more expensive machines. Handles 16″ trenches down to 24″ deep with ease... or flush digs alongside walls or fences.

the DAVIS HUSTLER UTILITY TRAILER

This 2000-lb. capacity, tilt-bed trailer for the T-66 and other loads has low center-of-gravity stability and load equalization suspension system. Sides optional.

the DAVIS PUP TRENCHER *Self-Propelled*

Digs by itself. This self-propelled trencher is driven by a six-speed winch mechanism. A productive tool for trenches 2″-3″ wide to 36″ deep, or 4″ wide, 18″ deep.

A REAL BACKFILLER

Heavy-duty, 42″ blade attaches to boom in less than 5 minutes. Blade can be set straight or angled left... raised and lowered hydraulically. Nimble maneuverability — no sluggish gear shifting — because of Instant Forward/Reverse. The T-66 as a backfiller is not an afterthought... it's designed that way.

We Welcome Competitive Demonstrations!

Owner's enthusiasm creates confidence that invites comparison. See why the T-66 is the new standard of values for trenchers. It's built by men who are leaders in the design of ditching equipment. **Ask about the T-66's 90-day unconditional guarantee.**

DAVIS MFG. INC.
1524 S. McLean Blvd., Wichita 13, Kan.

Please send me descriptive T-66 literature and the name of my DAVIS dealer____. I am also interested in the Davis Pup____ Davis Hustler____.

NAME_____

ADDRESS_____

TOWN_____ STATE_____

D1-261

For more details on above items, use reply card on page 19

imized earth disturbance during installation and increased helix diameters.

Hubbard engineers contend that by eliminating usual installation variables—digging, expanding, backfilling, and tamping—more consistently dependable and stronger anchoring is attainable.

A simple wrench, also available through Hubbard, transmits the torque from the power digger directly to the hub of the anchor wing.

Write U-606 on reply card, pg. 19

Lapp strut insulator

Struts, a versatile new multipurpose insulator design embracing a new method of controlled position construction for high voltage transmission lines, is available from the Lapp Insulator Co., Inc., Le Roy, N. Y.

The new insulators offer substantial convenience and cost reduction in transmission line construction.

Strut insulators consist of a solid, vacuum process porcelain post or rod, in a fog type design with galvanized, malleable iron caps cemented on the ends. The six-inch diameter units are available in five lengths with striking distances of 17, 23, 28, 31, and 34 inches, for use singly or in combinations of various units to match the electrical characteristics of any given number of suspension insulators.

Units are available with a standard strength porcelain body rated at 15,000 pounds ultimate strength in tension, or in a new high-strength porcelain rated 25,000 pounds ultimate in tension.

Struts are designed to take both compression and tension loading. End caps in a number of shapes and sizes adapt the new design to a variety of applications.

Write U-607 on reply card, pg. 19

Ohio Brass bushings

New oil-paper bushings have been added to the line of low-voltage transformer bushings from the Ohio Brass Co., 380 N. Main St., Mansfield, Ohio.

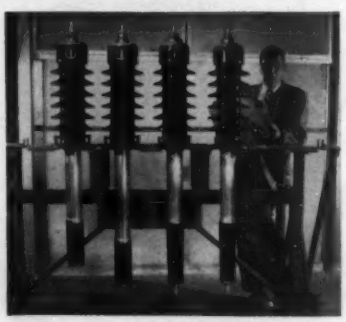
From 69-kv down to 15-kv service, these new class GK bushings will complement the Breaker-Tran line by covering the common dimensional requirements for transformer bushings included in Table 3, ASA Standard C76.1a-1958.

In each voltage class the 400-ampere, 16½-inch oil level and the 400-ampere, 21-inch oil level transformer bushings employ tubular conductors, draw-lead terminals, and no stud below the end cap.

The 1,200-ampere, 21-inch oil level transformer bushing uses a solid conductor that extends below the lower end cap and above the oil reservoir for attachment of leads.

Class GK, which not only includes these new Table 3 bushings but also covers the Breaker-Tran line and high voltage bushing line, is a full-condenser type with oil-paper construction.

Its paper insulation has been wrapped on the central conductor with condenser foils inserted at regular intervals for uniform grading across the dielectric and impregnated with and immersed in oil from end to end.



Write U-608 on reply card, pg. 19

Aluminum manhole sheave

A new manhole sheave with frame and sheave of aluminum alloy which weighs only 44 pounds, as compared to a previous malleable iron model weighing 110 pounds, has been added to its line by Templeton, Kenly, and Co., Broadview, Ill., manufacturers of Simplex jacks.

The new sheave, with its weight reduction, can be handled and placed by one man. It handles up to three-inch cable or any size winch line.

A two-foot long, ¼-inch chain with a hook is supplied for anchoring or protection when the winch line is released suddenly.

Write U-609 on reply card, pg. 19

Alcoa terminal protection

Peelable protection for any electrical conductor compression terminal—in the form of a cellulose dip coating on the pad surface—is now available from Rome Cable Div., Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.

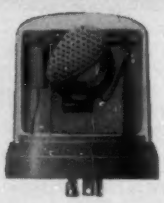
As easily removed as a banana peel, the protective coating guards the carefully ground pad surfaces against the rigors of shipping, storage, and handling.

Protected by the new coating, the ground pad provides a near-perfect electrical contact for bolted connections. The new protective medium eliminates possible contact between terminal pads and dirt or oxidizing conditions that would normally make necessary repeat installations.

The cellulose dip coating may be obtained on any Alcoa/Rome compression terminal (covering AWG No. 2 through 1,590,000 cm ACSR, and comparable sizes of stranded aluminum conductor). Applied as a standard protection to the company's extra-high-voltage conductor accessories, it is optional on other accessories.

Write U-610 on reply card, pg. 19

FOUND!



How To Keep Street Lights Burning

Take a simple, lightweight, compact photo control. Use Varistors in conjunction with the secondary lightning arrester.

RESULT: You eliminate the one biggest cause of photo control failure... transient voltage surges which are *below* the spark-over of lightning arresters.

That's LUMATROL MARK I...completely reliable! It withstands ALL transients up through the capability of the secondary arrester!

WRITE FOR BULLETIN 91a.

MICRO BALANCING, INC.
GARDEN CITY PARK, N.Y.

In Canada: J. R. KEARNEY CORP.
Box 270, Guelph, Ont.

Helpful literature

A 36-page catalog on **conductor stringing equipment** has been recently published by **Sherman and Reilly, Inc.**, 1st and Broad Sts., Chattanooga 2, Tenn. Covered in the booklet are spacer type aerial cable blocks; bundle conductor stringing blocks; lightweight, all-aluminum blocks; and the stringing of blocks by helicopter. The booklet is designed as a reference book of dimensional and working load information as well as a catalog of products.

Write B-611 on reply card, pg. 19

High-voltage **capacitor bank design** factors are described in a four-page technical bulletin, TPC-104, by Harold C. Stone, chief engineer, capacitors and power switching equipment, **Line Material Industries**, 700 W. Michigan St., Milwaukee 1, Wis. The bulletin includes tables for the proper selection of the rating of standard capacitor units and their connection for a variety of system voltages.

Write B-612 on reply card, pg. 19

Bulletin GEA-7133, four pages, from **General Electric**, Schenectady 5, N. Y., contains detailed information about bushing-mounted **load tap changing equipment** for large power transformers 120,000 kva and above. The bulletin stresses product features and applications and contains electrical diagrams, photographs, and other technical information about construction and operation of LTC equipment.

Write B-613 on reply card, pg. 19

Now available from **Metalectrics, Inc.**, 677 Broadway, New York 12, N. Y., is a new 48-page catalog, No. 61, illustrating its complete line of **solderless wire connectors**, ground cable, and conduit fittings. Planned with the user in mind, the catalog lists prices and catalog numbers side by side. A margin is also allowed for insertion in a binder.

Write B-614 on reply card, pg. 19

The new line of "Strut" **high voltage insulators** is described fully in "Controlled Position Construction," a new 16-page brochure available from the **Lapp Insulator Co., Inc.**, Le Roy N. Y. The brochure, No. 478-R, contains complete catalog information, including description, sizes, ratings, and drawings, plus photographs of the insulators, showing their application.

Write B-615 on reply card, pg. 19

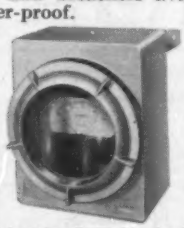
A four-page data folder on Blackburn **aluminum U-bolt clamps** for electrical conductors has been published by **Jasper Blackburn Corp.**, 1525 Woodson Rd., St. Louis 14, Mo.

Write B-616 on reply card, pg. 19

"Any size and style you need—because the Killark line is complete!"

Killark's complete line of more than 7,500 electrical fittings and fixtures (including over 200 Junction Boxes) is your assurance of getting the correct enclosure for every job. Choose Killark copper-free aluminum equipment in the size and style you need—for greater design freedom, better operating efficiency, lower cost. You'll get fast delivery from your distributor or a nearby warehouse.

*KILLARK "GR" SERIES JUNCTION BOX . . . available in eight sizes from 4⅝" x 4⅝" x 4½" to 11" x 12" x 8¼". Choice of dome covers in four heights to facilitate heavy splicing or mounting terminal blocks. Copper-free aluminum casting with reinforced construction and convenient mounting lugs. Custom hubs placed where needed; drains and breathers available. Explosion-proof, dust-tight, and weather-proof.



"GR" Junction Box with shock-proof stressed glass for instrument mounting

"GR" Junction Box with flat cover

Killark ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves. • St. Louis 13, Mo.

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

FIBER CONDUIT (NO CRETE CONDUIT).
STRAIGHT RUN ONLY

CONDUIT SIZE	HOURS "C"	LABOR COST PER FOOT OR EACH AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
2"	4.1	.082	.092	.103	.113	.123	.133	.144	.154	.164	.174	.185
3"	4.7	.094	.106	.118	.129	.141	.153	.165	.176	.188	.20	.212
4"	5.7	.114	.128	.143	.157	.171	.185	.20	.214	.228	.242	.257
	HRS.EACH	45 DEGREE ELBOWS			90 DEGREE BENDS (ADD AS REQUIRED)							
2"	.34	.68	.77	.85	.94	1.02	1.11	1.19	1.28	1.36	1.45	1.53
3"	.39	.78	.88	.98	1.07	1.17	1.27	1.37	1.46	1.56	1.66	1.76
4"	.44	.88	.99	1.10	1.21	1.32	1.43	1.54	1.65	1.76	1.87	1.98
		OFFSETS (ADD AS REQUIRED)										
2"	.44	.88	.99	1.10	1.21	1.32	1.43	1.54	1.65	1.76	1.87	1.98
3"	.49	.98	1.10	1.23	1.35	1.47	1.59	1.72	1.84	1.96	2.08	2.21
4"	.56	1.12	1.26	1.40	1.54	1.68	1.82	1.96	2.10	2.24	2.38	2.52
		ADAPTERS (TO STEEL) (ADD AS REQUIRED)										
1" to 2"	.27	.54	.61	.68	.74	.81	.88	.95	1.01	1.08	1.15	1.22
2" to 3"	.34	.68	.77	.85	.94	1.02	1.11	1.19	1.28	1.36	1.45	1.53
3" to 4"	.39	.78	.88	.98	1.07	1.17	1.27	1.37	1.46	1.56	1.66	1.76

E-102-B

LABOR: Includes cutting, tooling ends, installing straight runs and handling material at site.

6-61

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FITTINGS - FIBER CONDUIT "NO CRETE"
BELL ENDS AND PLUGS (ADD AS REQUIRED)

CONDUIT SIZE	HOURS EACH	LABOR COST EACH AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
2"	.28	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19	1.26
3"	.30	.60	.68	.75	.83	.90	.98	1.05	1.13	1.20	1.28	1.35
4"	.34	.68	.77	.85	.94	1.02	1.11	1.19	1.28	1.36	1.45	1.53
					EXPANSION JOINTS (ADD AS REQUIRED)							
2"	.56	1.12	1.26	1.40	1.54	1.68	1.82	1.96	2.10	2.24	2.38	2.52
3"	.58	1.16	1.31	1.45	1.60	1.74	1.89	2.03	2.18	2.32	2.47	2.61
4"	.67	1.34	1.51	1.68	1.84	2.01	2.18	2.35	2.51	2.68	2.85	3.02
					REDUCERS (ADD AS REQUIRED)							
1" to 2"	.28	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19	1.26
2" to 3"	.34	.68	.77	.85	.94	1.02	1.11	1.19	1.28	1.36	1.45	1.53
3" to 4"	.40	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80

E-101-B

LABOR: Includes handling at site, layout, tying and installation, cutting and tooling as required.

6-61

Electrical Estimating—III

FIBER CONDUIT BRIDGES 1" - 2 PIPE (ADD AS REQUIRED)

CONDUIT SIZE	HOURS EACH	LABOR COST EACH AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
2"	.12	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51	.54
3"	.12	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51	.54
4"	.17	.34	.383	.435	.468	.51	.55	.60	.64	.68	.72	.77
4½"	.17	.34	.383	.435	.468	.51	.55	.60	.64	.68	.72	.77
5"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
					1" SPACING 3 PIPE (ADD AS REQUIRED)							
2"	.12	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51	.54
3"	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
4"	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
4½"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
5"	.23	.46	.52	.58	.63	.69	.75	.81	.86	.92	.98	1.04
					1" SPACING 4 PIPE (ADD AS REQUIRED)							
2"	.17	.34	.383	.425	.468	.51	.55	.60	.64	.68	.72	.77
3"	.22	.44	.495	.55	.61	.66	.72	.77	.83	.88	.94	.99
4"	.23	.46	.52	.58	.63	.69	.75	.81	.86	.92	.98	1.04
4½"	.28	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19	1.26
5"	.28	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19	1.26

E-101-B

LABOR: Includes placing and tying in.

6-61

Electrical Estimating—III

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News of the industry

edited for Southern readers

Wiring profit workshop wins contractor praise

A "TRIAL-RUN" of the Commercial Wiring Profit Workshop, sponsored by the National Wiring Bureau, has been applauded by 20 electrical contractor participants as "excellent" and "awakening."

The concentrated, one-day session, held recently at the Park Plaza Hotel in Baltimore, Md., was an exhausting day, however, for the serious-minded contractors who participated. The tight schedule was organized around such topics as creative selling and sales tips, local market analysis, lead-getting, and promotion opportunities in the commercial modernization field.

The workshop, produced by the National Wiring Bureau in cooperation with the National Electrical Contractors Association, is available to any industry group wishing to sponsor it, locally.

The Baltimore "trial-run" workshop was sponsored by the Maryland NECA chapter in cooperation with sales training specialists Porter Henry and Company of New York, who developed the workshop.

Participants of the seminar were divided into groups of six or eight at a table for discussion purposes.

The "separate tables" scheme in Baltimore stimulated active participation among contractors and was unanimously favored in a post-conference critique.

Discussions were keyed to five services which an electrical contractor might offer (lighting, heating, electronics, modernization, and maintenance), and to various categories of customers (stores, offices, apartment houses, hotels and motels, food service establishments, professional services, personal services, plants and small shops, and churches).

Of particular interest to the contractors was a series of simply-prepared "home-made" movies of actual, unrehearsed interviews with successful electrical contractors. Interviews dealt with those topics around which the workshop was organized, and provoked immediate discussion, which is a major objective of the workshop.

The one-day format can be rescheduled, if desired, for three three-hour sessions or four 2½-hour sessions, whichever best suits a particular locality.

The workshop kit, which can be bought from the National Wiring Bureau, includes complete guidance data to organize and run the workshop; a large flip chart to visually guide the meetings; a loan of three ten-minute movies (actual contractor interviews); slide films (of outstanding modernization installations and materials available to the contractor from the National Wiring Bureau and other sources); a tape recording of a simulated sales call by a contractor on a prospective customer; and miscellaneous props, such as make-believe money.

The kit includes enough take-home working materials for 25 contractor-participants. A major element in these materials is a loose-leaf binder of "sight sellers," laminated folders describing and illustrating the benefits of electrical modernization to specific categories of customers.

The contractor would use a "sight seller" in the presence of a customer as a visual selling aid, and then might leave a copy with the customer to enable him to further ponder the benefits he will receive from greater electrical utilization. Included in the loose-leaf binder are elements for a contractor to assemble a presentation piece on his own establishment.

Over 130 attend IAEI five-chapter meeting

REGISTRATION at the annual joint five-chapter meeting of the International Association of Electrical Inspectors Code school and panel discussion reached over 130 for the recent two-day meeting, at the Windsor Hotel in Abilene, Texas.

Discussion of the National Fire Protective Association's electrical code began early and continued throughout the first day. A breakfast for IAEI secretaries was held the following morning, along with a sim-

Panel members for the International Association of Electrical Inspectors annual joint five-chapter meeting held recently in Abilene, Texas, were, left to right, Ben Z. Segall, registered professional engineer, New Orleans, La.; Frank Stetka, secretary of the electrical committee, Chicago, Ill.; H. H. Watson, member of the correlating committee and chairman of panel No. 2, Bridgeport, Conn.; Frank Camus, president of the C & C Electric Co., Shreveport, La.; Eustace Soares, industrial engineering service, Jersey City, N. J.; and H. Baron Whitaker, NFPA electrical committee chairman, New York, N. Y. Some 130 people attended the two-day session.

ilar breakfast for utility company representatives held nearby and sponsored by the West Texas Utilities Co.

L. A. Weber, electrical inspector for the city of Abilene, was host for the visiting inspectors. S. W. Thomas, chief electrical inspector for the City of Shreveport, La., and general chairman of the annual five-chapter meeting, was in charge of the sessions and called the meeting to order.

Questions to the panel were screened by the Code question correlating committee. The questions were presented to the panel in writing. Porter Lindsley, Jr., Matt Howieson, and Bob Payne were members of the committee.

The group selected Shreveport, La., as the site of the next annual meeting, April 27 and 28, 1962.

Westinghouse's Boatner becomes NAED president

B. H. Boatner, president of the Westinghouse Electric Supply Co., Pittsburgh, Pa., has been elected president of the National Association of Electrical Distributors.

Mr. Boatner succeeds J. A. Meier of Florida Electric Supply, Inc., Tampa.

Announcement of Mr. Boatner's election as NAED president came at the final session of the association's recent 53rd annual convention held in Cobo Hall Auditorium, Detroit.

Mr. Boatner leaves his post as NAED vice-president—Eastern region to take over duties as president of the association for one year. He will also serve as chairman of the association's ten-man executive committee during that time, as well as chairman of the board of governors.

Two new NAED vice-presidents also were elected for one-year terms during the convention. They are John M. Newton, Jr., president, Oakes Electrical Supply Co., Holyoke, Mass., who was elected vice-president—Eastern region, succeeding Mr. Boatner; and John W. Shealy, president, Shealy Electrical Wholesalers, Inc., Greenville, S. C., who was elected vice-president—Southern region.

Mr. Shealy succeeds T. C. Tread-

B. H. Boatner

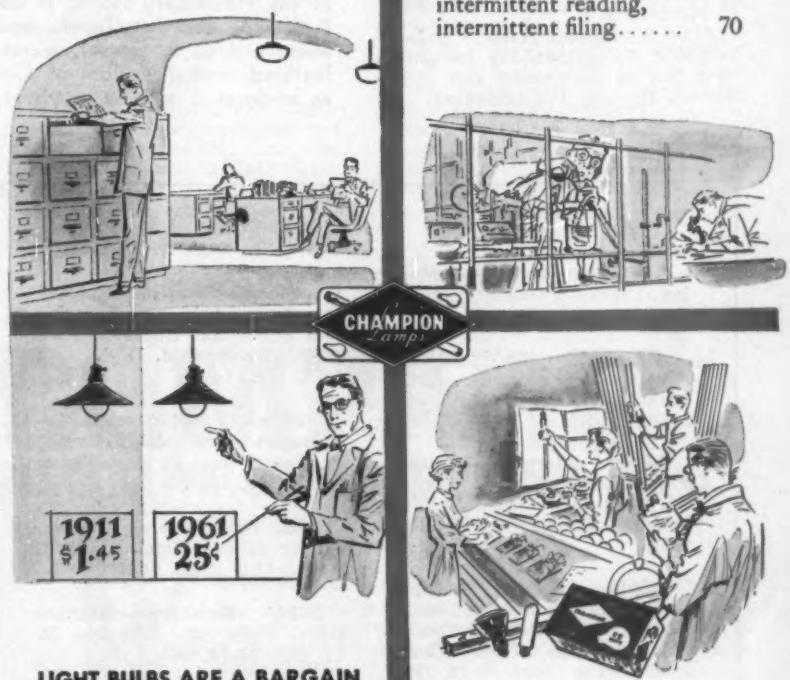
Facts of Light!

4, 9, 16, 25, 36
THE ARITHMETIC OF LIGHTING

The light you receive from a lamp varies inversely as the square of the distance you are from it. If you are 4 feet from a lamp and move away to 12 feet, you will receive only 1/9 the previous light.

RECOMMENDED ILLUMINATION LEVELS FOR RESEARCH FACILITIES

Seeing Task	Footcandles
Detail drafting, fine detailed model design	200
Instrument readings	100
Rough layout drafting, auditing, tabulating machine operation, calculating	150
Lab test set-up area (where exact quantities are measured)	100
Model set-up area, intermittent reading, intermittent filing	70



LIGHT BULBS ARE A BARGAIN

50 years ago a 100 watt bulb cost $1.45. In fact, if 1910 production methods attempted to supply today's demand, a 100 watt bulb would cost about $4.10. Today, you can buy a much better 100 watt bulb for 25 cents list.

OVER 200 INSPECTIONS GUARD CHAMPION LAMP QUALITY.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts
CHAMPION INCANDESCENT-FLUORESCENT

way, Jr., president, Treadway Electric Co., Inc., Little Rock, Ark.

Two other NAED vice-presidents were re-elected. C. E. Butler, Jr., president, Butler Electric Co., Inc., St. Louis, Mo., was re-elected vice-president—Central region.

In addition, K. P. Rehwaldt, district manager, General Electric Supply Co., Los Angeles, Calif., was re-elected vice-president—Western region.

The NAED vice-presidents also are members of the association's executive committee and the board of governors.

New fixture line shown at L&P annual meeting

SALES REPRESENTATIVES from 18 states were the guests recently of Light and Power Utilities Corp., for a two-day annual sales meeting held at their Olive Branch lighting plant in Mississippi.

Amid a program of tours and advertising discussions, the company's new line of fluorescent and incandescent fixtures was presented.

MISSISSIPPI IAEI MEETING—Officers of the Mississippi chapter, IAEI, are shown on the occasion of the chapter's annual meeting held recently at the Heidelberg Hotel, in Jackson. Standing, left to right, are Owen P. Jackson, chairman, Tupelo, Miss.; Fred G. Walker, co-chairman, Gulfport, Miss.; and C. B. Grauer, secretary-treasurer, Jackson, Miss. The meeting featured several sessions of Code discussions, with B. Z. Segall serving as moderator, and an excellent group of electrical equipment displays.

Dates ahead

AIEE Summer General Meeting, Cornell University, Ithaca, N. Y., June 18-23, 1961.

NECA, Carolinas' Chapter All-Industry Meeting, Grove Park Inn, Asheville, N. C., July 26-28, 1961.

Edison Electric Institute, Public Utilities Association of the Virginias, White Sulphur Springs, W. Va., Sept. 14-16, 1961.

Edison Electric Institute IIFEUC Eighth Annual National Electric Farm Power Conference, Leamington Hotel, Minneapolis, Minn., Sept. 20-22, 1961.

IES National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo., Sept. 24-29, 1961.

National Rural Electric Cooperative Association, Region III, Admiral Semmes Hotel, Mobile, Ala., Sept. 25-26, 1961.

Old Dominion Industrial Exposition, Inc., Statewide Industrial Exposition, "Index," Roanoke, Va., Sept. 27-30, 1961.

National Rural Electric Cooperative Association, Region I, John Marshall Hotel, Richmond, Va., Sept. 28-29, 1961.

National Electrical Contractors Assn., Annual Convention and Exposition, Sheraton Park Hotel, Washington, D. C., Oct. 9-12, 1961.

National Rural Electric Cooperative Association, Region X, Cortez Hotel, El Paso, Texas, Oct. 12-13, 1961.

AIEE Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich., Oct. 15-20, 1961.

IAEI, Southern Section, Grove Park Inn, Asheville, N. C., Oct. 16-18, 1961.

National Rural Electric Cooperative Association, Region II, Golden Gate Hotel, Miami Beach, Fla., Oct. 30-31, 1961.

Fourteenth Annual Power Distribution Conference, University of Texas, Austin, Texas, Oct. 30-Nov. 1, 1961.

National Rural Electric Cooperative Association, Region VIII, Jung Hotel, New Orleans, La., Nov. 2-3, 1961.

Sixth National Electrical Industries Show, New York Coliseum, March 11-14, 1962.

NAHB lighting schools to teach home buyers

FREE LIGHTING schools for home buyers, sponsored by the National Association of Home Builders, were recently inaugurated in Washington, D. C.

First held at the National Housing Center in Washington, the schools are to be presented throughout the country by local chapters of the NAHB and utility companies.

Speaking during the first school were Miss Rose Coakley, nationally-known lighting consultant for the Superior Electric Co.; C. Eugene Stephenson, fellow and past president of the American Institute of Decorators; and Bernard Shields, of the Potomac Electric Power Co.

The schools are set up for two-hour evening courses, with sessions repeated during successive nights to accommodate crowds.

"The ABC's of Light," by Miss Coakley, and "The Light Side of Decorating," by Mr. Stephenson, were two of the highlights, as well as a discussion on planning and installation by Mr. Shields.

Supply firm searches for new profit ideas

ELECTRICAL CONTRACTOR customers of Central Electric Co., Atlanta, recently attended a buffet dinner given by the company, and heard two manufacturer's agents discuss intercom systems.

Titled "Let's All Make Some

Howard Garret is explaining Nutone features. Pete Steel looks on, right.

Money," the event was held to discover additional sources of profit for the electrical contractor in the residential wiring field. The lecture and discussion periods were conducted by Pete Steel and Howard Garrett of the Nutone Co., who spoke on selling residential intercom systems to the builder and homeowner.

The speakers pointed out that the electrical contractor is the natural one to sell this merchandise, since the intercom boxes can go in at the same time the home is roughed-in, and the trim for the unit is set when the men are trimming-out and hanging fixtures. A discussion followed the talk.

David and Louis Lobel of Central Electric say other such sessions are planned, with different manufacturers' agents invited.

G&W increases coverage in five Southern states

GREGORY-SALISBURY Co., G&W Electric Specialty Company sales representative in the Arkansas and west Tennessee area, has been appointed to also handle G&W sales in Louisiana and Mississippi.

Strong representation in these four states, plus recent appointment of the Harry C. Johnson Company for G&W sales in Alabama, is expected to improve customer service throughout the area.

Brief news notes of manufacturers

A LICENSING AGREEMENT in the United States for the manufacture and distribution of electrical conductor accessories designed by Aluminum Limited was announced recently by the A. B. Chance Co., Centralia, Mo., and Aluminum Limited Sales, Inc., the United States sales subsidiary of Aluminum, Ltd.

Announcement of the licensing agreement was made jointly by Eric F. West, president of Aluminum Limited Sales, Inc., and N. A. Toalson, president, A. B. Chance Co. Under the licensing agreement, Aluminum Limited will supply Alcan designs and manufacturing techniques to the A. B. Chance Co.

• • •

THE NAME OF Slater Electric and Manufacturing Co., Inc., 45 Sea Cliff Ave., Glen Cove, Long Island, N. Y., has been changed to Slater Electric, Inc., it was announced recently by the company.

• • •

RUSH CONSTRUCTION of a new 52,000-square-foot plant and office for Phil Rich Fan Manufacturing Co., Inc., has begun on a five-acre tract at 6000 Telephone Rd., Houston.

The $250,000-plus building, of reinforced concrete and masonry throughout, was designed by Joseph Krakower, AIA.

Plans call for initial air conditioning of the 3,700 square feet of office space. A cafeteria is provided for Rich's 100 to 200 people.

Increased sales, government contracts, and new product developments made the expansion necessary as soon as possible, according to Hershel Rich, president of the firm.

Before you buy . . .

COMPARE*

BLACKHAWK SERVICE ENTRANCE MAST

builds your reputation for quality and service

Check these fittings against any others on the market.

Slip-fitter service entrance head — Just slip it on over conduit and tighten two set screws. That's all. Made of corrosion-resistant aluminum. Available in a full range of sizes.

Insulators — Reinforced, durable, well-rounded porcelain secured to metal pipe mounting clamp, galvanized pull-off fitting available uninsulated.

Flexible Synroflashing — Made of flexible neoprene to absorb vibration. Mast can't work loose, damage shingles or cause leaks. Won't rot, peel or crack in any weather. Available for 1¼, 1½, 2, 2½ and 3" pipe.

MOUNTING BRACKETS — New combination bracket accommodates 1¼, 1½, 2, 2½, and 3" pipe. Available with ½" thru bolts or with lag screws.

OFFSET REDUCER — Corrosion-resistant aluminum alloy. Fits 1¼" and 1½" hubs to a 2" or 2½" pipe riser and 2" hub to 3" pipe riser.

Available as a complete kit or as separate fittings.

Blackhawk Industries

Where the new ideas come from
DUBUQUE, IOWA

News about people

Recently appointed assistant to the vice-president in the Westinghouse Electric Corporation's Southwestern apparatus sales region, is **Vern O. Clements,** it has been announced by **Lamar W. McLeod,** vice-president and regional manager.

Mr. McLeod at the same time announced the appointment of **William M. Oliver** as manager of the company's south Texas district, the position formerly held by Mr. Clements. Headquarters for both men are located in Houston, Texas.

Mr. Clements graduated from Kansas State University with a degree in electrical engineering in 1924, and also studied at the South Texas School of Law.

Mr. Oliver received a degree in electrical engineering from Texas A & M College in 1941.

Gerald Preacher has been appointed representative for the Wakefield Company in the state of South Carolina, it was announced recently by that company.

An electrical engineering graduate from the University of South Carolina, Mr. Preacher will have headquarters at 116 N. Church St., Lexington, S. C.

Prior to his new appointment, Mr. Preacher was in private business as a consultant electrical engineer and as a manufacturers' agent for commercial lighting fixtures.

Christopher T. Kastner has been appointed manager of manufacturing at General Electric's Power Transformer Dept., Pittsfield, Mass., it was announced by department general manager **Gerald A. Hoyt.**

Mr. Kastner, a graduate of Yale University, comes to his new position from Hickory, N. C., where he was manager of the Distribution Transformer Department's branch plant.

The former Power Transformer Department manufacturing manager, **Philip H. Alspach,** has been appointed manager of division planning for General Electric's Industrial Electronics Div.

Three top-level promotions have been announced by South Carolina Electric & Gas Co.

President **S. C. McMeekin** has reported that new positions and responsibilities have been accorded as follows:

Vice-president **F. R. McMeekin** (no relation to the president) will become vice-president and general manager.

Arthur M. Williams, Jr., vice-president and staff counsel, will become senior vice-president and, in addition to his duties as staff counsel, will have general supervision of public relations activities as well as other special assignments.

George L. Dibble will become vice-president in charge of electric operations and engineering.

The new vice-president and general manager joined the firm in 1925. He was named vice-president in charge of operations in 1952, and in 1959 was elected to serve as a director and as a member of the executive committee.

He received a degree in electrical engineering from Clemson College in 1923.

Mr. Williams joined South Carolina Electric & Gas in 1944 as director of personnel and industrial relations. He was named staff counsel in 1948 and was promoted to vice-president in 1959.

He received a degree in textile chemistry at Clemson in 1936. He served in the regular Army Cavalry from 1936 to 1938 when he entered the University of South Carolina Law School, from which he was graduated magna cum laude in 1942.

Mr. Dibble has been with the company since 1946. In 1960 he became manager of engineering, production, and transmission. He received a degree in electrical engineering at Auburn in 1936.

F. R. McMeekin

George L. Dibble

A. M. Williams, Jr.

Douglas K. Bogart has been appointed sales promotion manager of Preformed Line Products Co., according to **Edmund H. Brown,** vice-president in charge of sales.

For the past ten years, Mr. Bogart has been engaged in the creative and administrative phases of advertising, merchandising, and sales promotion for leading Cleveland companies, including Bryant Heater Div., American Steel & Wire Co., and Reliance Electric & Engineering Co.

He graduated from Fenn College, School of Business Administration, Cleveland, in 1949.

Douglas K. Bogart

W. C. MacInnes, president of Tampa Electric Co., was named Tampa's "Outstanding Citizen for 1960" at the annual Florida Governor's Luncheon held in Tampa.

Business and political leaders from throughout the state were present as Mr. MacInnes received the 32nd annual Civitan award at the luncheon sponsored by the Florida State Fair and Gasparilla Association.

Attorney **Morris White,** who made the presentation, called it a "diploma for excellence in citizenship" and "outstanding service."

The Van and Smith Co., Inc., manufacturers' representatives, recently announced that **Richard H. Osgood, Jr.,** has joined the company as sales engineer.

His office will be located at 1444 June St., Jacksonville, Fla. Mr. Osgood will represent Allen Bradley Co., G and W Electric Specialty Co., Standard Transformer Co., and Cornell-Dubilier Div.

Named manager of marketing at General Electric's Power Transformer Dept., Pittsfield, Mass., is **George H. Hupman.**

The appointment was announced by department general manager **Gerald A. Hoyt.**

Mr. Hupman moves to his new position from the company's Ordnance Dept., where he served as manager of product design and development. He succeeds **N. Eugene Dillow** who has been named general manager of the company's new Bushing Products Section.

Mr. Hupman obtained a BS degree in physics from Union College in 1942. In 1947 he received General Electric's highest honor, the Coffin Award, for developing the world's smallest oscillograph.

Recently named manager of engineering for the Ft. Atkinson, Wis., residential lighting fixture manufacturing plant of Thomas Industries, Inc., Louisville, Ky., is **Wallace T. Rouse.**

The appointment was announced by **Frank J. Marriett,** director of engineering for the company.

Until recently, Mr. Rouse was associated with the Hamilton Manufacturing Co., Two Rivers, Wis., as product development manager. He succeeds **Charles J. Stuart,** who has been named manager of the Ft. Atkinson plant.

Mr. Rouse is a graduate of the University of Kansas.

Promotion of **L. E. Simon** from process engineer to manager of the recently consolidated process and tool engineering departments of Electro-Motive Division of General Motors was announced recently by **J. H. Anderson,** manufacturing facilities manager.

The promotion of **G. W. O'Leary** to general supervisor of the process engineering section of the new process and tool engineering department was also announced.

Mr. Simon graduated from the University of Wisconsin in 1937 with a BS degree in metallurgy. He began his General Motors career upon his graduation, joining the General Motors Research Laboratories in Detroit.

L. E. Simon

Mr. O'Leary attended General Motors Institute during the years 1940-43 and then entered the Navy. Upon completion of his tour of duty he went to Yale University, receiving his bachelor of mechanical engineering degree in 1946, after which he returned to General Motors.

Thomas Hollingsworth, general sales manager for Hubbard and Co., has been elected vice-president in charge of sales of the company.

He will operate from the company's new executive offices at 5401 W. Roosevelt Rd., Chicago.

T. Hollingsworth

Before joining the Hubbard organization, Mr. Hollingsworth was manager of product planning for Westinghouse Electric Corp. He is a graduate of the University of Texas where he received his bachelors degree in electrical engineering.

A top-level reorganization of key executives at Goddard, Inc., electric components distributors headquartered in West Palm Beach, has affected the following changes:

George Larkin, formerly manager of Goddard-Tampa, Inc., is now vice-president in charge of the company's over-all dealer sales. Named to assist Mr. Larkin is **Cecil Hutcherson,** salesman, who fills the newly created position of dealer sales manager for the electronics components distributors.

Jim McGee, vice-president in charge of consumer product sales, takes on additional duties as top West Palm Beach area salesman of consumer and dealer products.

Joe Lewis, manager of Goddard's Gainesville branch, moves up to vice-president in charge of over-all procurement for the company's dealer and industrial divisions.

Newly appointed salesman **Arthur Brown** has been named by the George E. Anderson Company to cover the Texas Panhandle area, it was announced recently.

The Anderson Company operates as

LEVITON QUALITY TALKS

New Shallow Residential Type Grounding Receptacles Listed by Underwriters' Laboratories, Inc.

Complies with N.E.C. Code

These low-cost, high-quality, 3-wire U-Ground Duplex Receptacles are designed to fit shallow mounting boxes and the "handy" boxes found everywhere in thin wall construction trailers, partitions and prefab homes. Two types of receptacles are available: No. 1215 for conventional-loop side wiring and No. 1297 for both side or "straight-in" back wiring.

You'll save on-the-job time and trouble with these inexpensive devices: a new removable fin-feature makes it easy to convert them to 2-circuit wiring. What's more the units have staked 8-32 binding head screws and green hex grounding screw. One binding screw at each contact is backed out to simplify the job.

These devices are one-piece construction in brown phenolic or ivory thermosetting plastic. They take up to #12 conductors and accommodate two-wire standard or polarized caps as well as three-wire U-Ground types. Double-wipe bronze contacts give you better grip and longer life and captive mounting screws permit fast, easy installation.

Catalog No. 1215
Rating: 15A.—125V.

LEVITON QUALITY TALKS BUSINESS

LEVITON®

LEVITON MANUFACTURING CO., INC.,
BROOKLYN 22, N.Y.
Chicago —— Los Angeles —— Montreal, Canada

Contact American Insulated Wire Corp., Pawtucket, Rhode Island, a Leviton subsidiary, for a complete line of insulated wire and cable products.

an electrical manufacturers' representative agency.

Mr. Brown, whose headquarters will be 1118 Smiley St., Amarillo, Texas, has had training of two years in Lubbock and six years in Amarillo with Westinghouse Electric Supply Co.

Robert Craighill Hunt, of Atlanta, Ga., sales representative for Line Material Industries Div., McGraw-Edison Electrical Co., died unexpectedly April 25, while playing golf at the Sea Island Country Club in Georgia.

Mr. Hunt attended Hampton-Sidney College and William and Mary College. He was a member of the Georgia Engineering Society.

The appointment of **Gordon M. Henderson** as salesman for the Ridge Tool Company has been announced by **R. D. Fye,** sales manager.

Mr. Henderson will represent the complete line of Ridgid pipe tools throughout the state of Florida.

Technical books

for the electrical man

Crossover networks

"All about Crossover Networks," by Howard M. Tremaine, Sc.D. Published by Howard W. Sams and Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind., 80 pages, charts and tables included, $1.50.

Written primarily for audiophiles, hi-fi enthusiasts, and electronic service technicians, the book contains much information about frequency-dividing systems used to channel audio amplifier frequencies to hi-fi loudspeakers.

The book goes into complete detail on theory and design, using simple logic. Charts and tables are included for those interested in designing and building their own crossover networks.

The main sections of the book cover general network theory, network design, network construction, and network testing and use.

Radio and electronics

"Practical Radio and Electronics Course," by M. N. Beitman. Published by Supreme Publications, 323 W. Polk, Chicago, Ill., 216 pages, 400 illustrations, $3.95.

A complete home study course, complete with "teacher's comments" and a question and answer guide for testing yourself, is included with this book.

Beginning with the basic mechanics of radio, and with the basic mathematical formulas utilized in this study, the book goes on into such things as how meters work, vacuum tubes, power supplies, audio amplifiers, and radio accessories. Radio frequency, detection methods, receiver circuits, electronic oscillators, and transmitter circuits are also covered.

Detailed explanations of thyratron tubes, photocell equipment, high frequency heating, aircraft direction finders and beacons, and electron microscopes are a few of the other subjects covered.

Finally, the course includes servicing techniques and practical hints in both radio and television repairing.

Network synthesis

"Introduction to Modern Network Synthesis," by M. E. Van Valkenburg, Professor of EE, University of Illinois. Published by John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y., 498 pages, illustrated, $11.75.

This text and reference covers the basic methods of modern network synthesis, enabling the design of networks for various applications, including communications and automatic control systems. The author combines a thorough treatment of applied mathematics, with applications to practical situations.

Because of the great number of methods that this subject encompasses, the author has selected those which are most essential and has discussed them in detail. This technique permits him to concentrate on a number of foundation topics, and to explain them fully enough to effect a real understanding of them.

Positive real functions, the foundation of network synthesis, are studied first. Elementary synthesis procedures are covered for the LC, RC and RL, and RLC cases.

Associated topics of approximation and the relationship of the parts of network functions help complete a study of one terminal-pair network synthesis. The book introduces the subject of two terminal-pair synthesis with Cauer ladder development.

The major modern methods of this type of synthesis are described, and the important properties of network functions that explain these networks are enumerated. Also covered is synthesis by the image parameter method.

Analogue computers

"Analogue Computation," by Stanley Fifer, president, Dian Laboratories, Inc. Published by McGraw-Hill Book Co., Inc., 327 W. 41st St., New York 36, N. Y., four volumes, 1,370 pages, 921 illustrations, $39.00.

To extensively cover the four essentials the analogue computer needs for proficiency is the basis of this newly published four-volume work.

It gives a wide and detailed range of information relating to ability to understand the origin of a problem, working knowledge of the necessary mathematics, familiarity with the techniques of analogue computation and essentials of high accuracy and precision, and insight into the principles of operation of computer components needed for optimum use.

Of special interest is the coverage of practically all classes of analogue computers, pointing out the similarities and differences among the various types. Also, the volumes deal not only with programming or design, but with the physics of the problem, the mathematics of the formulation, programming and trouble-shooting, and the engineering involved in the computer design.

Attention is focused on error analyses of components and solutions, to facilitate evaluation and optimization of the accuracy and precision of solutions.

Some of the special topics covered are Fourier analysis, the potential analogue, the secular equation, the polynomial equation, and partial differential equations.

Among the recent advances discussed are electronic multipliers; applications of computers to automation; introduction of transistors, thermal, and magnetic components; and automatic, static, and dynamic checking systems.

Electronic timesavers

"Electronic Tips and Timesavers," by John A. Comstock. Published by Howard W. Sams & Co., Inc., 2201 East 46th St., Indianapolis, Ind., 96 pages, $1.50.

Over 300 highly ingenious, time- and money-saving tips are listed in this book—tips the average reader couldn't even begin to think of. Over 1,000 of the author's hints have appeared in scores of electronics, mechanics, and photography magazines.

Written in a down-to-earth style and illustrated by the author, these hints will help to solve many of the problems the electronic technician, engineer, builder, experimenter, or hobbyist might face.

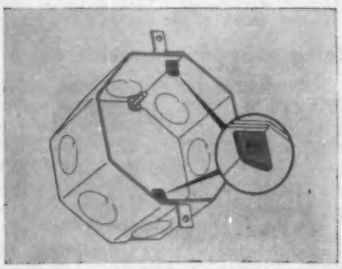
New products

Arrow protective compound

The Arrow Conduit & Fittings Corp., 108-20 180th St., Jamaica 33, N. Y., manufacturers of outlet boxes, covers, and box supports, has introduced a protective compound.

One of the most time consuming problems of the electrician on the job has been the time required to remove concrete from tapped holes in the ears of concrete rings.

Arrow Conduit has developed a plastic compound called Aro-Gard that is put on during the manufacturing process for permanent protection of the tapped holes. Aro-Gard is



hard enough to keep concrete from entering the tapped holes, yet soft enough to allow screws to penetrate the protective film with considerable ease.

Aro-Gard does not have to be cleaned out of tapped holes before inserting screws. It also prevents concrete from sticking firmly to the ear-lug.

The electrician can identify the presence of Aro-Gard by its bright green color. Arrow Conduit is now including it on all concrete rings at no additional cost.

Write P-617 on reply card, pg. 19

Lightolier chandeliers

A collection of new chandeliers, in a stylistic range that includes fixtures of every decorative theme, from the country classic to traditional elegance, or simple contemporary and transitional, has been introduced by Lightolier, Inc., 346 Claremont Ave., Jersey City 5, N. J.

Each chandelier is engineered to perform with efficiency. Many are constructed with the Hi-Lo switch, permitting full room glow or candlelight effects, or with built-in spotlights.

Another innovation can be found in the chandeliers that have a framework of candleholders. These have been constructed so that the shades rest on plastic diffuser discs, thereby maintaining perfect alignment.

A chandelier to meet every decorative mood, and for every room in the house, even the kitchen, bathroom, powder room, and of course, living and dining rooms, expresses the theme of this extensive collection.

Write P-618 on reply card, pg. 19

Westinghouse bus duct

A form of bus duct for 100-ampere electrical systems is now being offered by Westinghouse Electric Corp., Standard Control Div., Beaver, Pa.

It is intended to provide the advantages of a rigid distribution system for installations where small blocks of power are used. Typical applications are in small shops, laboratories, garages, motels, and other places where conduit and cable are now applied.

The new bus duct has a continuous rating of 100 amperes, with a voltage rating of 600 volts for three-wire systems and 277/480 volts for four-wire systems.

Each section has completely captivated hardware, with no loose screws or bolts to drop. Joints snap together by means of special high pressure spring clips, eliminating the need for bolting them. Two plug-in openings are located every two feet along the length of the run.

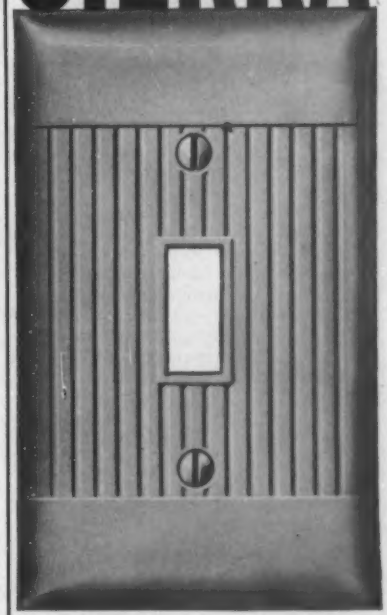
A ten-foot section can easily be installed, using only one simple clip-on hanger. The duct also is available in five-, three-, two-, and one-foot sections. Almost all installations can be completed with the standard straight lengths, together with other standard cable tap boxes, end closers, elbows, and tees.

Write P-619 on reply card, pg. 19

Cable suspension system

The Line-Flex system, an entirely new, thoroughly proven method of permanently or temporarily suspending electrical cable in industrial, mining, and other applications, is

SIERRA



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Sierra Plastic Plates meet all codes and are listed by UL

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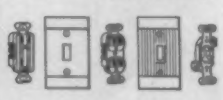


now available from Perfect-Line Manufacturing Corp., Old Country Rd., Hicksville, Long Island, N. Y.

The unique suspension system, offering complete flexibility in one plane or non-sag rigidity in the opposing plane, requires no special equipment, tools, or training to install.

It is designed to be used in non-supported rigid lengths of up to 14 feet or catenary applications involving lengths of 400 or more feet.

Superceding conduits, ducts, baskets, or troughs in many applications, Line-Flex is among the few types of cable sheathing which may be placed in tension without distortion or damage. In obstacle-studded installations Line-Flex can be bent along its flexible plane using radii much smaller than allowed equivalent standard conduit.

Several hundred feet of cable may be pulled through as many as three 90-degree angles by hand, and in far less time than with conduit, etc., by two-man crews. No mechanical "puller" is required.

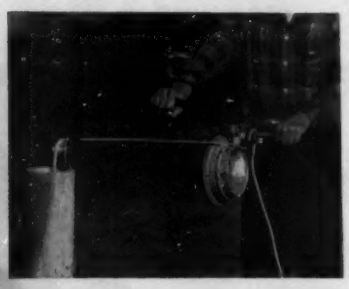
Write P-620 on reply card, pg. 19

Jet Line wire puller

Jet Line Products, Inc., 615 Fugate Ave., Charlotte, N. C., recently introduced a new wire puller which allows one man to do the work of six men pulling by hand—safely and without strain.

The most unique feature of the wire puller is that the rope (or cable) is not stored on the pulling drum. Instead, the drum automatically takes up, then pays off the rope—thus permitting runs of any distance.

This feature also means constant pulling power. With no build-up of stored cable on the drum, there is no loss of power. The new wire puller delivers a constant 20-to-1 power ratio throughout the entire pull, without strain.



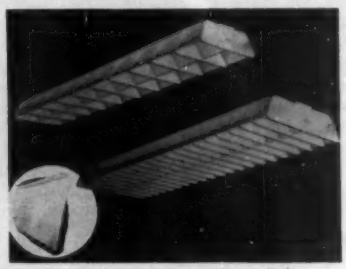
The puller works well with any type conduit: metal, plastic, or fiber, and is ideal for aluminum conduit. Because the puller grips the pipe, the pull can be started anywhere along the run.

Write P-621 on reply card, pg. 19

Benjamin commercial fixture

A new unit with refractor-lens sides has been added to the Versateer line of commercial fluorescent lighting fixtures produced by the Benjamin Division of Thomas Industries, Inc., 207 E. Broadway, Louisville 2, Ky.

The low-brightness, plastic side panels show an attractive louver image and increase visual comfort



by redirecting light out of the glare zone. The panels are clear polystyrene plastic and are .143 inches thick. Linear refractors are extruded on the inside, leaving a smooth outer surface, thus reducing maintenance problems.

The Versateer is designed to meet the high lighting standards required for modern classrooms, offices, and other similar installations. It is one of the most economical units of its type available. Standard units are available with 35- by 25-degree or 45- by 45-degree louvers in either two- or four-lamp construction.

Write P-622 on reply card, pg. 19

Federal Pacific breakers

A new line of type NB molded case circuit breakers, featuring bolted construction to give positive connection between the breaker and the main bus, has been introduced by Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.

A lighting and power circuit breaker available in one, two, and three poles with ratings from 15 through 70 amperes, the new device is designed for the protection of electrical distribution circuits from overload and short circuit conditions.

It can also be used as a switching device in the control of distribution circuits. Typical applications include use in power and lighting panelboards for commercial buildings, industrial plants, and residential buildings.

Besides being engineered with bolted connecting tabs, the type NB circuit breaker also features center handle trip indication to show when the circuit breaker has functioned against an overload or short circuit. The entire device contains but three moving parts.

Write P-623 on reply card, pg. 19

Kulka snap-in lampholders

New one-piece fluorescent lampholders designed for three-second snap-in mechanical installation and minimum lamp contact resistance have been developed by Kulka Electric Corp, 633-643 S. Fulton Ave., Mt. Vernon, N. Y.

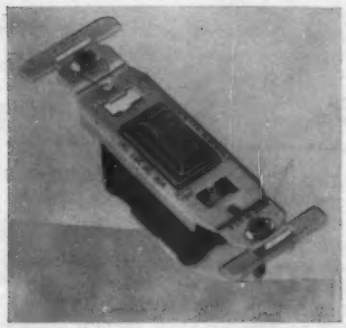
The new types 582-583 recessed contact lampholders, designed for Power Groove, high output, and VHO lamps, utilize silver-plated phosphor bronze contact springs. The UL listed lampholders are rated at a full 600 volts, 660 watts. They are made with white urea and can be snapped in from the front without taking the fixture apart.

While the mounting dimensions of the lampholders are the same as other lampholders, they are designed to permit additional movement as a safety factor, in case mounting distances are not exactly followed, and for out-of-tolerance fluorescent lamps.

Write P-624 on reply card, pg. 19

Eagle quiet switch

Eagle Electric Manufacturing Co., Inc., 23-10 Bridge Plaza S., Long Island City 1, N. Y., has rounded out its quiet switch line with the introduction of its four-way Touch-A-Matic.



Equipped with enclosed sure-tight wire (rear) pressure terminals, the Touch-A-Matics provide fast, easy wiring at low costs, and at the same time prevent haphazard connections.

The Eagle Touch-A-Matic is a low decibel quiet switch with light touch instant action. Packaged in an individual cellophane-wrapped "Sho-Pak," it is UL listed.

Write P-625 on reply card, pg. 19

Allen-Bradley motor starters

A complete line of new Bulletin 709 across-the-line motor starters — designed to meet today's more critical requirements for greater reliability, increased mechanical life, and smaller size — has been announced by the Allen-Bradley Co., 136 W. Greenfield Ave., Milwaukee 4, Wis.

This new Bulletin 709 line is offered in seven starter sizes. These employ the same "one moving part" solenoid principle used successfully in the present Allen-Bradley starters. However, the design is entirely new, and both size and weight have been drastically reduced, especially in the higher ratings.

While achieving unusual compactness, continuous tests during the many years of their development have conclusively shown that — rating for rating — the mechanical life and electrical reliability will far exceed the previous construction. Thus the possibility of field troubles —even after years of service — has been greatly reduced.

The new starters feature double break contacts of an improved cadmium oxide silver that resists welding. In addition, the contacts are so shaped that they seat squarely upon closing — without wear-causing twisting or sliding.

Write P-626 on reply card, pg. 19

G-E 'Twin' load center

A new line of three-phase, four-wire "Twin" load centers featuring complete sequence phased bussing has been announced by the Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

The two-in-one breaker may be plugged in anywhere on the extra wide, sequence-phased bus. In addition, single- and two-pole breakers may be installed directly opposite G-E's new 100-ampere TQAL plug-in breaker, now standard with lugs suitable for copper or aluminum wire.

Other key features in the new line include fronts with breaker openings removed at the factory (four filler plates are furnished with each device for unused spaces, and extras are available as accessories); completely reversible box, front, and interior; a tumbler type door lock accessory with the same standard key size used for many panelboards; and four-inch gutters for TQL lighting panels.

The new UL listed panels are rated 120/240 and 120/208wye volts a-c, three-phase, four-wire, and 240 volts, three-phase, three-wire. All are main-lugs-only devices with lugs approved for use with either copper or aluminum conductors.

Write P-627 on reply card, pg. 19

Bell outdoor cover plate

New from Bell Electric Co., 5735-47 S. Claremont Ave., Chicago 36, Ill., is a small, Mini-Plate weatherproof outdoor cover plate that is curved to fit post lanterns in driveways, walkways, gardens, and doorways.

The curved Mini-Plate has Bell's patented Saf-T-Lok snap cover; it snaps open, stays open, and snaps shut at a finger touch. It is completely weathertight and fully gasketed.

Mini-Plates can provide the needed electric current to add sales appeal to post lanterns, barbecue carts, mobile homes, motorboats, cabin cruisers, and a variety of other applications.

The plates are available with parallel-slot single receptacle; three-wire grounding type single receptacle, or Saf-T-Lok Mini-Plate only, without receptacle.

The new plate covers an area two

MORE BEAUTY IN OUTDOOR LIGHTING

WRITE FOR CATALOG S-61

STONCO lighting

STONCO ELECTRIC PRODUCTS CO.

333 MONROE AVE., KENILWORTH, N.J.

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For more details on above items, use reply card on page 19

by three inches. It is rugged, constructed of .040 solid brass, and finished in baked aluminum enamel. The plate is also available in other painted finishes or unpainted, if desired. It is rustproof and corrosion-resistant and meets rigid specifications.

Write P-628 on reply card, pg. 19

Safety multiple lockout

A new lightweight multiple lockout for electric switch and fuse boxes has been introduced by Industrial Products Co., 2820 N. 4th St., Philadelphia, 33, Pa.

Slots are provided for six padlocks so that each workman may have his own padlock and key assuring that the box cannot be re-

activated until all men working on the line have completed their work.

The two ends of the lockout are said to provide for virtually any type of electrical equipment, even in the latest large-handled, front switching units.

Write P-629 on reply card, pg. 19

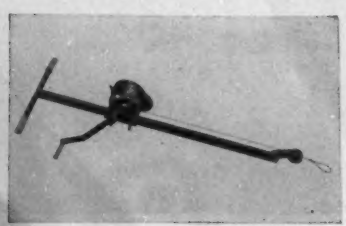
Greenlee cable puller

A new lightweight electricians' cable puller weighing 29 pounds has been announced by Greenlee Tool Co., 2136 12th St., Rockford, Ill.

Only 30 pounds of handle pressure is required to pull 1,500 pounds, thus making it an easy job for one man. This new No. 766 cable puller features two-speed operation with three-to-one and nine-to-one ratios. It fits all outlet boxes and is equipped with 200 feet of aircraft steel cable.

Patented winch ratchet action plus open-side construction of the pulley support also provide new operating efficiencies. The frame is of high tensile square tube construction to take heavy pulls and constant use.

Write P-630 on reply card, pg. 19



Helpful literature

available to our readers

The new line of type SF surface-mounted **fluorescent luminaires** made by **Westinghouse Electric Corp.**, Lighting Div., Edgewater Park, Cleveland, Ohio, is described in a new booklet now available from the company. The six-page publication shows typical applications and points out various features of the fixtures.

Write B-631 on reply card, pg. 19

General Electric's Communications Products Dept., P. O. Box 4179, Lynchburg, Va., has issued a 16-page non-technical businessman's **guide to two-way radio.** Titled "Under the Influence of Radio" (ECR-568A), the pocket-sized publication informs potential mobile communications users of some of the more important FCC licensing requirements. It discusses operational methods, such as how a message is sent, how to adjust a mobile radio, and record-keeping.

Write B-632 on reply card, pg. 19

Thermal insulations for all types of commercial and industrial requirements, in applications ranging from —400 F to 3,000 F, are completely described in a newly revised 64-page catalog, IN-244A, published by **Johns-Manville Corp.**, 22 E. 40th St., New York 16, N. Y. Entitled "Insulation Product Information" IN-244A contains six complete sections, each devoted to a specialized group of thermal insulations. Information on each product consists of an application photo, description, available forms or types, advantages to users, and detailed specification data, including compliance with government specifications and ASTM standards.

Write B-633 on reply card, pg. 19

A new catalog published by the **Electric Heating Div., Cavalier Corp.**, 343 W. First St., Chattanooga, Tenn., gives complete data on that company's new **electric heating units.** The illustrated catalog covers the Cavalier long length baseboard heaters; the Kwik-Tatch automatic electric heaters, which hang on the wall like a picture; and the wall insert heaters, with heating elements totally enclosed in ceramic. Descriptions and specification details are covered.

Write B-634 on reply card, pg. 19

"Maximum value for your lighting dollar" is the theme of a catalog giving complete details on the new line of **industrial fluorescent lighting** fixtures designed by the Benjamin Div., **Thomas Industries Inc.**, 207 E. Broadway, Louisville, Ky. The catalog (bulletin F) describes in detail the completely new line which covers all lamp types including Power-Groove, 800-ma, slimline, and rapid-start. In addition, two all new double embossed porcelain enameled reflectors in either ten or 25 per cent upward components are covered in the catalog. A full line of accessories is also covered.

Write B-635 on reply card, pg. 19

Chromalox electric comfort **heating equipment** is treated in complete and concise fashion in new catalog 975-D for the architect, consulting engineer, client, and contractor, now available from **Edwin L. Wiegand Co.**, 7500 Thomas Blvd., Pittsburgh 8, Pa. Valuable application and product information is included on all 16 pages for solving residential, commercial, and industrial comfort heating problems. Each equipment item is covered with explanatory copy, illustrations, dimensions, engineering, and application data. Products covered in the new catalog range from baseboard heaters to industrial blower units.

Write B-636 on reply card, pg. 19

A two-color, 36-page catalog from the **Atlantic Transformer Co.**, 8330 Hegerman St., Philadelphia 36, Pa., describes in detail their line of single phase, three-phase, and phase changer **dry type transformers.** One of the most complete and comprehensive dry type transformer catalogs published, the publication has many transformer photographs, wiring diagrams, specifications, and prices.

Write B-637 on reply card, pg. 19

Bulletin EFL-960, recently published by the **Appleton Electric Co.**, 1701 Wellington Ave., Chicago 13, Ill., covers complete specifications for their Intenso Econoflood line of **commercial and industrial floodlights.** Photographs, diagrams, and various charts are contained in the booklet, including a page of photometric data showing the amount of illumination obtained from the fixtures at various distances.

Write B-638 on reply card, pg. 19

Latest information on National Electrical Code requirements most likely to affect the installation and operation of portable electric tools and equipment is available in the revised edition of **"Grounding Facts"** an eight-page illustrated booklet published by the **Arrow-Hart & Hegeman Electric Co.**, 103 Hawthorn St., Hartford 6, Conn. The booklet inter-

prets and clarifies revised Code requirements and provides up-to-date information on new types of grounding devices developed especially to satisfy the new requirements for safety.

Write B-638 on reply card, pg. 19

Condulets and the National Electrical Code are discussed in bulletin 2722, a 60-page publication from **Crouse-Hinds Co.,** Wolf and 7th Sts., Syracuse 1, N. Y., detailing the applications of condulets in hazardous locations. Code Articles 500-503 and 510-517 are quoted, along with recommendations for meeting the Code requirements. More than 300 product photos, installation photographs, and drawings illustrate this informative bulletin.

Write B-640 on reply card, pg. 19

The new catalog of **fluorescent lighting fixtures** from **Keystone Electric Manufacturing Co.,** 2228 E. Tioga St., Philadelphia 34, Pa., includes four distinct, color-keyed sections covering the engineered line of specification type surface-mounted units, a 22-page troffer section, RLM industrial units, and the Martline economy units.

Write B-641 on reply card, pg. 19

Explosion-proof and dust-tight lighting fixtures are covered in complete specification listings in bulletin 2000, published by **Appleton Electric Co.,** 1701 Wellington Ave., Chicago 13, Ill. Parts and accessories are listed and diagramed for incandescent, mercury vapor, and fluorescent lighting fixtures.

Write B-642 on reply card, pg. 19

Bulletin GEC-983Q, a 24-page publication from **General Electric Co.,** 1 River Rd., Schenectady 5, N. Y., contains revised tables of prices and data for the company's full line of **ballasts** for fluorescent lamps. The publication has sections on the new "Bonus Line" and totally weatherproof ballasts as well as applications and operating data on the company's other indoor and outdoor ballasts. Cross-section dimensions, wiring diagrams, an obsolete ballast replacement table, and installation instructions are included.

Write B-643 on reply card, pg. 19

Pfaff & Kendall, 84 Foundry St., Newark 5, N. J., has just issued a new 12-page catalog of davit style **lighting standards.** The davit, introduced a number of years ago, has now begun to take hold as an accepted element of contemporary outdoor lighting design. In the new catalog, P & K has classified the various davits available by mounting height and by arm extension.

Write B-644 on reply card, pg. 19

Generator controls and Trans-O-Matic automatic transfer switches are described in a new four-page general bulletin published by **Lake Shore Electric Corp.,** 205 Willis St., Bedford, Ohio. The company's "Unified Control," combining generator control circuits, transfer switch, and optional automatic engine control panel and battery charger, is illustrated, showing compactness and economy possible with the simplified design. Also illustrated are auxiliary controls, including the differential voltage relay and transistorized voltage regulator.

Write B-645 on reply card, pg. 19

A new bulletin that details the operating and safety requirements of **service-entrance equipment** has been published by the **Pringle Electrical Manufacturing Co., Inc.,** Dept 99, 1900 N. 6th St., Philadelphia 22, Pa. The bulletin, entitled "Facts You Should Know about Service-Entrance Equipment," covers the three basic aspects of the service-entrance function: current-carrying efficiency (including heat rise at contacts), manual switching facility (under adverse conditions that include overloads), and speed and capacity of short-circuit interruption.

Write B-646 on reply card, pg. 19

Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y., offers a new brochure on **bank lighting.** The brochure discusses good lighting, lighting as a plus-or-minus factor, artificial lighting, ceiling lighting, contrast, the lighting engineer, and the Holophane consulting service. It includes photographs taken in nine different banks. They illustrate entrance lighting, customer-floor lighting, consulting-room lighting, and office lighting. They also portray both traditional and modern settings.

Write B-647 on reply card, pg. 19

A new line of electric infrared comfort heaters for **direct radiant heating** of indoor and outdoor areas without costly heating of the intervening air is described in the new eight-page, two color bulletin CH-100 available from **Fostoria Corp.,** 1200 N. Main St., Dept 87, Fostoria, Ohio. Principles, advantages, and typical applications of electric infrared comfort heating are discussed.

Write B-648 on reply card, pg. 19

Ceilheat, Inc., 5212 Homburg Dr., Knoxville 19, Tenn., has issued new descriptive literature on its **high density baseboard** with optional thermal cutout protection. The company has also issued a new price schedule for its entire line.

Write B-649 on reply card, pg. 19

Delcords, a new series of Del-Valites featured in the new, more comprehensive Del-Val catalog of distinctive **lighting fixtures** for interior and exterior home use, is now off the press at **Del-Val Manufacturing Co.,** 519 W. Huntington St., Philadelphia 33, Penn.

Write B-650 on reply card, pg. 19

THE ONLY SWITCH OF ITS KIND

AT NO EXTRA COST

In Single Pole 3 Way 4 Way Also In Interchange Type

EAGLE

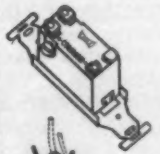
TOUCH-A-MATIC

Pat No. 2,743,330

QUIET SWITCH

An E-Z Wire Device

15A and 20A—120-277V AC



With BOTH Screw And E-Z WIRE Pressure Terminals

3 COMMON TERMINALS For Convenient Feed Thru Connections

AUTOMATIC POSITIVE ACTION

Works Mechanically Not Manually

PRESS IT TAP IT

INSTANT ACTION

FLIP IT ROLL IT

SEND FOR FREE SAMPLE

SOLD THRU WHOLESALERS ONLY

"Perfection is not an Accident"

EAGLE ELECTRIC MFG. CO., INC.

LONG ISLAND CITY 1, NEW YORK

Wood pole conference

(Continued from page 95)

ent of Pennsylvania Power and Light Co., Hazelton, Pa.

Mr. Campbell stated, "About 15 years ago, the promotion of groundline applications for standing treated poles began. Interest in such applications was stimulated around 1950 on the part of pole users, through a number of premature failures on poles treated during and for the two to three years after World War II.

"During this period, shortages in standard preservatives and pole supplies had been accompanied by the wide use of new and unproved preservatives and species. Some of these premature pole failures are continuing to show up but, with improvements in pole treatment specifications, the situation appears much less serious than it did several years ago.

"There is still room for improvement in preservative and treating specifications."

The application of groundline treatments to treated poles has been suggested and used also in cases where poles are removed and reinstalled, where soil has been excavated from around the groundline zone for inspection or other purposes, and where changes in grading have resulted in a change in the original grounding.

It is felt by some, although apparently without conclusive evidence, that there is a serious depletion of preservative at this critical groundline zone of the pole in such cases. If such is actually the case, common sense would seem to indicate a need for "booster" treatment to replace the depleted preservative.

There is some evidence to indicate, however, that preservative depletion below the groundline of poles is much less than is commonly supposed, and much less than the loss in the part of the pole exposed above ground.

Assuming there is a need for supplementary treatments on standing treated poles, it does not logically follow that the improved pole serviceability, noted in the case of untreated cedar and chestnut poles, can be expected when such applications are made on treated poles, particularly on poles of other species and characteristics.

A groundline preservative treatment for standing treated poles, in addition to being reasonable in cost of application, should function as follows:

(1) Be applicable to the commonly used pole species.

(2) The preservative should penetrate the previously treated sapwood to sufficient depth and in sufficient quantity to protect the wood. In the case of thin sapwood species such as western red cedar, western larch, and possibly Douglas fir and lodgepole pine, improved pole service may also depend on preservative penetration into the heartwood.

(3) The protection provided should be for a long enough period to justify the cost of the groundline treatment.

(4) The treatment should be applicable to poles installed in different areas and under different conditions of soil and climate.

(5) The groundline treatment should definitely add to the life of the treated pole to which it is applied.

Inadequate wiring

(Continued from page 86)

an inside installation of the same capacity and circuit positions, because of the ease and standardization of the initial installation.

From actual surveys which have been made of electrical contractors in the Southeast, it has been found that an outside service entrance panel installation containing six double-pole circuit positions will cost only 50 to 75 per cent as much as the same size installation located on the inside.

This saving in rewiring cost to the customer can be from $30 to $100, depending upon the size of the installation and associated problems of installing.

The inadequacies of the residential service entrance facilities can be corrected at an over-all saving to the customer if:

(1) The builder of new dwelling units installs service entrance equipment with capacity and circuits to carry the present connected load and with adequate provisions for serving the future load, with emphasis on the availability of 240-volt, double-pole circuit positions.

(2) The electrician replacing the service entrance equipment in an existing dwelling unit uses new equipment which will permit maximum use of the existing equipment and provide capacity and facilities to add future loads. This may require a new approach to the methods previously used in rewiring.

(3) The electrical industry works closely with the National Electric Code and local electric code personnel to revise the codes wherever necessary to allow the maximum use of existing wiring equipment whenever new service entrance equipment is being installed.

(4) The electrical industry works closely with the local electric code personnel to revise the codes wherever necessary to eliminate the main disconnecting means, thereby permitting the six means of disconnect.

(5) The electrical equipment manufacturers design a split bus panel in such a manner that the National Electrical Code rule allowing six means of disconnect cannot be violated.

(6) The electrical industry promotes an educational program explaining that the service entrance equipment and other wiring within the dwelling unit should exceed the minimum standard as prescribed by some governing body.

The question of handling future residential load growth is an extremely important problem, and the electrical industry should face it with all of its engineering know-how in an attempt to find a solution that is practical, economical, and safe.

Substation loads

(Continued from page 80)

switches, and fuses to bypass equipment.

(2) Use of mobile equipment for both maintenance and new construction.

(3) Use of full capacity feeder ties between adjacent substations to transfer loads during emergencies, construction, etc. On our system a popular size for 12.5-kv feeder ties is 477 MCM ACSR.

(4) Use of portable or permanently installed fans to provide emergency capacity for serving loads of adjacent banks on substations. Portable fans are usually available in two hours during emergencies.

(5) Use of combinations of these may be required in large construction projects.

Load capabilities of transformers are dependent on temperature limits that will limit loss of life to acceptable values. New large capacity transformers have temperature indicators in the windings where temperature limits must be observed to pursue the chosen loss of life policy.

Older equipment depends on top oil temperature which must be translated into winding tempera-

tures on the basis of assumed temperature gradients.

For operators, a more easily followed schedule is one having load limits in per cents or per unit of nameplate rating. This varies with load factors and contours and we have developed such schedules based on these varying conditions both for self-cooled and fan-cooled or forced-cooled conditions of the transformer.

Table No. 2 shows the operating guide to meet our loading policies.

In view of the relatively low load on most substations during fall, winter, and early spring months, these months are most generally chosen where thermally limited equipment must be taken out of service for overhaul or maintenance. Major construction involving equipment outages must also be scheduled then, too, since these are usually done after existing equipment has become fully loaded by summer peaks.

Since our load characteristics are not readily subject to control, our techniques and equipment must be used to most economically adapt to the existing conditions. An accurate knowledge of these load characteristics gained by adequate meters is an indispensable tool in achieving this goal.

Code application

(Continued from page 54)

motor controllers, and fuses which are installed in areas containing dust from magnesium, aluminum, aluminum bronze powders, or dusts from other similarly hazardous metals are required to be provided with enclosures specifically approved for the locations.

Paragraph (b) of Section 502-6 requires all switches, circuit breakers, motor controllers, and fuses, including pushbuttons, relays, and similar devices which are installed in Class II, Division 2 locations, to be provided with tight metal enclosures designed to minimize the entrance of dust with tight-fitting or telescoping covers and free from holes or other openings through which arcs, sparks, or hot particles could escape and ignite combustible material.

Mounting holes are required to be on appendages outside of the enclosure.

Class II requirements will be discussed further in the next issue.

Answers to Code test questions: (1. **F** Section 502-1) (2. **T** Section 502-1, fine print note) (3. **T** Section 502-2-a-1) (4. **F** Section 502-2-a-3) (5. **T** Section 502-3) (6. **b** Section 502-4-a) (7. **c** Section 502-4-b) (8. **c** Section 502-4-a-2) (9. **a** Section 502-5) (10. **a** Section 502-6-a-1).

New capacitor control

(Continued from page 72)

switching operations resulting from short fluctuations.

As the load increases toward its peak the voltage at the location in question may be 122 volts at the current value chosen for switching capacitors on.

For switching to take place, the voltage regulating relay has to sense a lower voltage when the current relay picks up so the balance beam will drop enough to energize the "close" circuits.

The current bias rheostat control must be set at a value such that the change in the voltage distribution in the voltage relay circuit will result in enough voltage decrease across the voltage relay that the balance beam will fall to the lower limit position.

By setting the bias control to nine volts the voltage regulating relay will effectually act as though the source voltage to the control is 113 volts. The capacitor switch will "close" after the time delay.

Under these conditions, the control panel is operating on the second plateau and the capacitors are energized. The voltage on the line will show an increase because of the capacitors.

If an abnormal condition developed that would push the voltage up to 127 volts the voltage sensing part of the control would trip the capacitors off the line.

As the load decreases, the current bias rheostat would be short circuited at 70 per cent of the pick-up value and the panel would revert back to a voltage sensitive control. Since the voltage on the control would be close to 122 volts, which is well above the upper limit of 118 volts, the capacitors would be switched off.

The high impedance pickup coil is imbedded in a porcelain insulator. Its output is a voltage directly proportional to the current flowing in the power line lashed in the conventional way across the insulator top.

The insulator base, with suitable fittings for conduit, is screwed on a pin on the pole crossarm or other support. Since the device is coupled to the line inductively, no breaking into the line or dead-ending is necessary.

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For more details on above items, use reply card on page 19

Installation is much quicker and easier than is accomplished with current transformers.

The ratio of line current to voltage is 60 amperes to one volt. However, the control is not phase sensitive because operations depend on relay action. Another feature is that the pickup coil is not damaged if the line is energized with the coil open circuited.

The current bias shorting relay is mounted in a conventional six-point watthour meter type socket on the upper part of the case.

The voltage signal from the inductive pickup is fed into a simple magnetic amplifier which governs operation of the bias shorting relay.

The line current pickup value is set by turning an adjustment knob on the rear of the relay mount. The relay must be withdrawn from the socket to make the adjustment.

The current relay range is one to five with currents up to 5,000 amperes. A typical rating may be 60 to 300 amperes with the pickup adjustable at any value between these currents.

The voltage sensitive part of the control is patterned after the control used on feeder voltage regulators and uses many of the same parts.

The calibrated voltage level rheostat is adjustable from 105 to 130 volts, the band width is adjustable from zero to 12 volts, and the current bias rheostat may be varied from zero to 30 volts.

An important feature is a self contained variable voltage test circuit, Caliband, which permits accurate setting of the voltage level at any point between 105 and 130 volts even if the incoming source voltage is lower than the voltage level to be set.

Voltage compensated thermal timers, a control power circuit breaker, a counter, and lightning arrester complete the circuit.

Since the new capacitor control simplifies installation, makes field adjustment easy, and provides the proper control characteristics for a variety of operating conditions, it is expected that this type capacitor control will find increasing use.

Transformer loading

(Continued from page 69)

commercial load with air conditioning.

Max-I-Meter tests during the summer indicate a bank of three 25-kva transformers is carrying 90 kva or 120 per cent of name plate rating. As the stores are open 12 hours on one day each week the peak duration must be taken as 12 hours.

From the 86 F curve of Figure 2, the safe load is found to be 106 per cent of transformer rating, indicating the bank is overloaded. As the allowable load is 106 per cent of transformer rating, read also from Figure 2 a peak load factor of 0.94.

$0.94 \times 90 = 84.5$ kva transformer capacity (28.2 kva per transformer) is required for this load.

As this load is expected to remain relatively static with about three per cent annual growth rate, from Figure 3 it is determined that three 37½-kva transformers should be installed.

It is interesting to note that if over seven per cent annual load growth is expected, three 50-kva transformers would be installed.

IES conference

(Continued from page 46)

factors such as even the posture of the child must all be taken into consideration in school lighting.

He mentioned, too, that since new discoveries in design and lighting are being made almost daily, that now when a school is being completed, it is already obsolete in design.

Appearing on the afternoon program, Dr. O. D. Johns, associate professor of education at the University of Oklahoma, told of the trend of the school in the nation and of the resulting financial problems.

He predicted that as schools become larger, they will in turn become more of a community center than they are presently, which will in turn bring about the need for higher levels of illumination.

On the morning of the last day of the conference, presentations were given in the Skirvin Hotel in Oklahoma City for the applied

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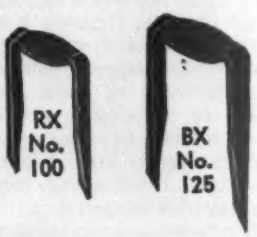

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lighting competition under the direction of R. B. Gow of the Central Oklahoma chapter.

Winner of the first place award in the residential lighting division was Glenna Kobel, Central Oklahoma chapter. Second place winner was Alice Fuller, North Texas section, and L. H. Kindel, Coastal Bend chapter, was third place winner.

In the commercial lighting division, J. D. Weeks was the first place winner, representing the San Jacinto chapter. J. G. Harris, Ark-La-Tex chapter, was second place winner, and the third place award was made to Ruth Maddox of the North Texas section.

On the afternoon program, talks and slide presentations were made by Ruth Coakley, Superior Electric Co., New York; Eric Church, Lighting Products, Inc., Highland Park, Ill., and by Robert T. Dorsey, General Electric Co., Nela Park, Cleveland, Ohio.

A summation of the three-day conference was given by John B. Deck, Jr., vice-chairman of the Southwestern Region.

Shopping center job

(Continued from page 41)

us 20 minutes, we blew lines through 200 feet of conduit in a minute or two with a jet pressure system.

Another timesaver in carrying out our job was pulling all branch circuits before the ceilings were covered. Wiring up the show windows, ceilings, and interiors before these were covered up, we knew where everything was going. Normally a job does not have enough help. By doing this we could come back and keep men working on this job when weather was bad at other jobs.

Lighting, including mercury vapor lamps on the parking lot, was fed from a 277-480-volt system.

Headquarter facilities

(Continued from page 41)

Clellan said, a ten per cent saving on labor affected. Also prefabricated is angle-iron framework for hanging transformers, and mounting switches and starters.

McClellan electricians on the job determine their needs at least a day in advance and telephone them to the shop, where they are prepared for moving out the next day. By having materials and tools in advance the electricians can better coordinate a day's work.

Proper job supervision, in close coordination with the home office, is the single most important factor in the electrical contracting business, Mr. McClellan asserted. "This does not mean overlapping in supervision of a job," he said. "Job details are worked out at the office, then we advise the supervisor of what's wanted and give him full rein from there.

"Our policy is to install a job exactly as it's specified. So, when the supervisor runs into a hitch, such as a piece of heavy equipment not fitting as called for in the plans, he phones details of the hitch to the office and continues on another line of work.

"Here at the office we size up the problem and work out a solution if we can. If not, we call in the architect and have him make the necessary adjustments. The solution then is relayed to the supervisor.

"With this method we don't have to tear up for changes after concrete is poured or the job has progressed too far otherwise. Neither do we look for loopholes and so-called shortcuts. The fastest and most economical way is doing a job right the first time."

McClellan time- and laborsaving efforts are not confined to the office. For example, a piece of flatiron, one-eighth by one inch, bent at a 90-degree angle, has proved of tremendous benefit in installation of receptacles, Mr. McClellan said.

As he explained: The flatiron "height spacer" is used to bind a receptacle box to an exact specified height during installation. The spacer is nailed to the floor and the box fastened by locknut to the upright end of the flatiron. Conduit has been pre-fabbed to fit into the box and is held there, rigidly, during pouring of concrete and other construction. The spacers do not have to be removed, of course.

Without the spacer, Mr. McClellan said, the box may be as much as an inch or two too high or too low after the concrete has set if the conduit has been jarred by a wheelbarrow or otherwise. Then an electrician will have to use additional time to adjust the box to the specified height.

"We save from 50 cents to a dollar on each receptacle installation," Mr. McClellan said. "On a really large job the saving obviously can be considerable. On small jobs we prefab our own spacers; on large ones, we buy them. The cost is only a few cents each."

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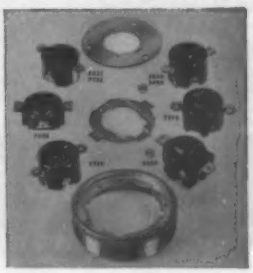

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McClellan Electric Company is equipped to bid any size, any type job, but for the most part confines its operations to metropolitan Birmingham. Most of the company's work is commercial and industrial, with infrequent residential work.

Tall building

(Continued from page 42)

east core of the building. One 500-kva transformer is located on this side, the other 500-kva transformer has been installed on the west side.

Ten main feeder lines in the east core lead through aluminum conduit to cable tap boxes on each floor. The RHW cables lead to the distribution panels on each floor. Both a high voltage side and low voltage section have been installed, with the high voltage section taking care of the fluorescent lighting fixtures which have 265/460 wiring.

The incandescent lighting and convenience outlets are tied into the low voltage panel which has 120/208 TW wiring on the branch circuits. Practically all of the lighting on the main or lobby floor, which includes the tellers' cages and the general business area, is recessed incandescent lighting, with 1,084 such fixtures in this area alone. More than 12,500 fixtures, most of them fluorescent, are to be installed throughout the building.

On the third floor, Spang underfloor duct carries wiring from the low voltage distribution panels to numerous floor outlets, most of which will be used to connect the IBM equipment that will be in the room.

About 19,500 feet of underfloor duct in slab floors will be used in the building, but extensive use of Spang headerduct, approximately 14,800 feet, will be laid in the cellular floors.

Cellular floors have been constructed from the second to the 19th floor, with the headerduct used to carry auxiliary, power, and telephone wiring to the junction boxes and access units. These access units are of square design to match the shape of the floor tiling, and have large capacity to ease the job of running the wires.

Three separate runs of headerduct are used on each of the floors to allow outlets within a few inches of each other in any part of the room.

Another unusual feature is the six- by six-inch control center gutter that runs through the center of the building from the basement to the 19th floor motor control center. This auxiliary system is used for such functions as the communications and music systems, and connects back through the distribution panels into the headerduct in the cellular floors.

In the eight-story garage and motor bank directly across the street, a 300-kva transformer is located on the eighth floor near the cafeteria, which will feed from the east core high voltage main in the basement of the main building.

A 75-kva transformer has also been installed in the motor garage to supply power to distribution panels that take care of large signs on the east and west ends of the eight-story building.

Three 30-kva transformers have also been installed, two of which supply power for the emergency system, such as exit, stairway, and elevator lights.

Breakers in the panels on each floor in both buildings range from 200-amp in the high voltage section down to 20-amp single pole breakers for the low voltage side that leads to the branch circuits.

The electrical system in the building was designed by the engineering firm of Yandell, Cowan and Love of Fort Worth. Associated architects were Preston M. Geren, Fort Worth, and Skidmore, Owings and Merrill, New York City.

Big project wiring

(Continued from page 38)

"We figure each van saves us two hours of labor daily for each three-man crew.

"In my work as a journeyman for many electrical contractors, I have often seen the folly of permitting a mechanic to leave his job to visit the supply house for some needed item, to waste time there around a sales counter. We can't afford that in our type operation."

As a consequence, aside from his responsibility of seeing that every item, down to the last screw, goes into the boxes destined for the rough-in crews, where work has piled up, Mr. Orcutt may load aboard the vans just enough set-ups to dispatch the men when they arrive at the shop in the morning, in order to insure a fast start.

He travels around later in the day with the remaining set-ups in a small truck in which is carried an assortment of minor items for which the men may have need.

As competition stiffens and prof-

it margins grow leaner, many contractors are prone to scrutinize their cost of doing business. In the case of Port Charlotte Electric, this means having complete control over every operational phase, since completion dates must be met and the firm works against a tight construction schedule. Accurate bookkeeping is a must and ways to develop increased efficiency are constantly sought.

While Mr. Covington points to "dollars in the bank" as a result of having a comprehensive supply of needed materials on hand well in advance of their use, there is no evidence of overstocking, considering the magnitude of the Port Charlotte operation.

Obviously, a complete inventory prevents crews from wasting their time because of material shortages. Since the organization is ever on the alert to discover new techniques or materials that save time, Mr. Wingate cites one case.

"We were using a type of wirenut to fasten splices which required twisting the wires together, picking up a tool to insert the cap and squeeze it locked, and then adding the rubber covering insulator.

"We abandoned this type in favor of a more simplified wingnut which only requires twisting the wires together and screwing the wingnut on by hand."

With an expected population at Port Charlotte of 40,000 by 1965, this Port Charlotte contractor foresees a continuing profitable operation via the same kind of mass production effort applied to house wiring as is evident in other areas of industry.

Washington report

(Continued from page 6)

Also, because of the swing in opinion, it will be easier for non-union contractors to win government contracts. Strikes to force non-union contractors from jobs—illegal but winked at—no longer will be tolerated as easily as before.

Although it is likely that on the whole, electrical contractors will benefit from the McClellan hearings, there is a good possibility that at missile bases some electrical contractors will lose a few jobs. These are contractors doing work that could be done easier, better, or cheaper in a factory or by factory employees at the job site.

Building trades unions had won much work by fighting for these jobs. It is unlikely that their

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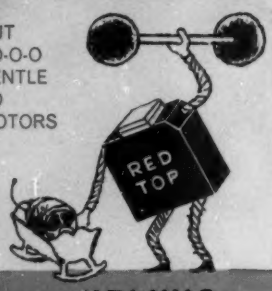
BUT SO-O-O GENTLE TO MOTORS



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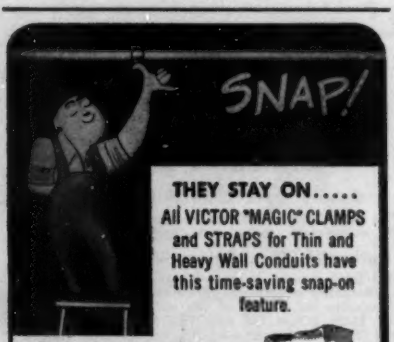

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jurisdictional claims will continue to be honored in the future as they were before the hearings.

Jude M. Joseph, president of Modern Electric Contracting Co., Jacksonville, Fla., was one of the witnesses. His comments revealed the situation that he and other Cape Canaveral contractors faced.

Asked by Senator McClellan about an expensive work stoppage that involved his company, Mr. Joseph replied:

"I can't say the men are not patriotic . . . . It's more a matter of personal greed . . . to get more work and overtime."

Mr. Joseph said that IBEW Local 756 sent him "journeymen" who had " . . . no experience at all. They cannot do the work of journeymen. They might be able to act as helpers." The local struck after he fired the men. He was forced to rehire them, he said.

An apprentice electrician in the local earned $11,000 one year, according to government witnesses. Other electricians earned between $11,000 and $25,000. They did this by working overtime with pay rates at times quadruple the $3.50 an hour base rate.

The McClellan committee also heard testimony that at missile bases the IBEW locals insisted on performing work on equipment—such as welding electrical connections—that could have been performed more easily, better, and cheaper in the factory.

Some testimony traced equipment failures to poor on-the-site electrical work that should have been done in the factory.

Among proposals for legislation to curb these union abuses were (1) repeal of the Davis-Bacon Act, which building unions used in jurisdiction disputes; (2) amendment of the Taft-Hartley Act to let the government sue unions for damages; and (3) blacklisting of unions and individuals in work stoppages at missile bases by barring them for three years from bases.

Senator McClellan, himself, said that missile base strikes and other strikes on government contracts should be made illegal. But after receiving a promise from the White House to provide a remedy, the Senator recessed the hearings. Presumably he is waiting to see what the White House proposes.

One thing was made clear in the hearings. The efforts by the headquarters of building trades unions to stop missile base strikes have not worked. Since the "no strike" pledge in February, one witness said, there have been 37 work stoppages at missile bases.

Clearly the government must use legal power if this country is to keep in the space and missile races.

Economic comment

(Continued from page 4)

dividual and usually reacts unfavorably upon the individual's financial position. It becomes doubly dangerous when a family must live on the proceeds of an estate left by someone who mismanaged financial affairs during his lifetime.

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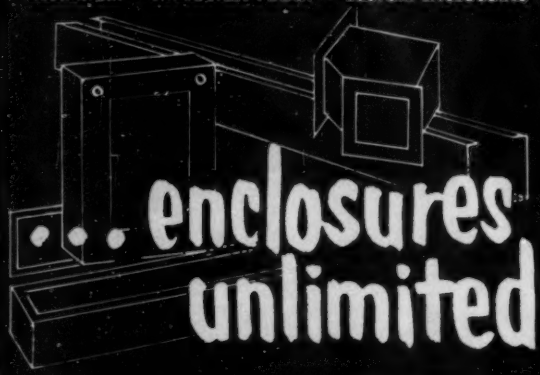

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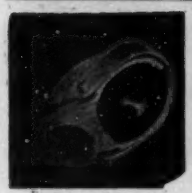
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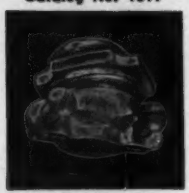
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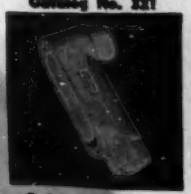
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ADVERTISER'S INDEX

A

Accurate Mfg. Co. 121
Adam Electric Co., Frank 33
Advance Transformer Co. ....Second Cover
Allen-Bradley Co. 35
Allis-Chalmers Mfg. Co....79, 81
American Steel & Wire Div., U. S. Steel 76, 77
Amprobe Div., Pyramid Instrument Corp. 17, 18
Anaconda Wire & Cable Co... 60
Appleton Electric Co. 1
Atlantic Conduit Fittings Co...126

B

B & C Metal Stamping Co..... 64
Blackburn Corp., Jasper 21
Blackhawk Industries 107
Bulldog Electric Products Div., I-T-E Circuit Breaker Co. 26
Burndy Corp. 29
Burns Co., James F. 126
Bussman Mfg. Co. ....Back Cover

C

Champion Lamp Works 105
Chance Co., A. B. 96
Chelsea Fan & Blower Co., Inc. 53
Classified Ads 122
Corrosion Reaction Consultants 2
Cross Co., W. W. 118

D

Davis Mfg. Co. 99

E

Eagle Electric Mfg. Co. Inc. ..115
Electrical Fittings Corp. 7
Elliott Electric Mfg. Corp.....120
Estimating Handbooks Associates 121

F

Fargo Mfg. Co. 84
Fisher-Pierce Div., Sigma Instruments, Inc...88, 89
Flintkote Co., (Orangeburg Div.) 30
Fullman Mfg. Co. 119

G

General Electric Co., Apparatus Sales Div. (Meters) 61
General Electric Co., Circuit Protective Devices Dept. 22
General Electric Co., Large Lamp Dept. 51
Globe Company 2
Graybar Electric Co. 34
Greenlee Tool Co. 24, 25

H

Helwig Carbon Products, Inc. 122
Hubbell, Inc., Harvey 16

I

Ideal Industries, Inc. 12

K

Kerite Company 56
Killark Electric Mfg. Co. 101
Knox Porcelain Co. 117
Koenig Iron Works, Inc. 98

L

L & P Lighting 27, 28
Leviton Mfg. Corp. 109
Line Material Industries 91

M

Micro Balancing, Inc. 100
Miller Company 23
Minneapolis-Honeywell Regulator Co. 31
Moe Light Div., Thomas Industries, Inc. 13
Moloney Electric Co. 87

N

Noland Co., Inc. 8

O

O. Z. Electrical Mfg. Co., Inc. 10, 11
Orangeburg Mfg. Co., Inc. 30

P

Phelps Dodge Copper Products Corp. 32
Precision Multiple Controls, Inc. 98
Preformed Line Products Co. 93, 94
Pyramid Instrument Corp., Amprobe Div. 17, 18

R

Ripley Co., Inc. 87

S

S & C Electric Company 62, 63
Sangamo Electric Co. 92
Sierra Electric Corp. 111
Southern States Equipment Corp. 58, 59
Southwire Company 5
Square D Company .....Third Cover, 9
Sta-Brite Fluorescent Mfg. Co. 55
Stonco Electric Products Co. 113

T

Theil Tool & Engineering Co., Inc. 122
Thomas & Betts Co. 47
Thomas Industries, Inc., Moe Light Div. 13

U

U. S. Steel Corp., American Steel & Wire Div. 76, 77

V

Victor Specialties 122

W

Wadsworth Electric Mfg. Co. 120
Wagner Electric Corp. 65
Want Ads 122
Westinghouse Electric Corp... 73

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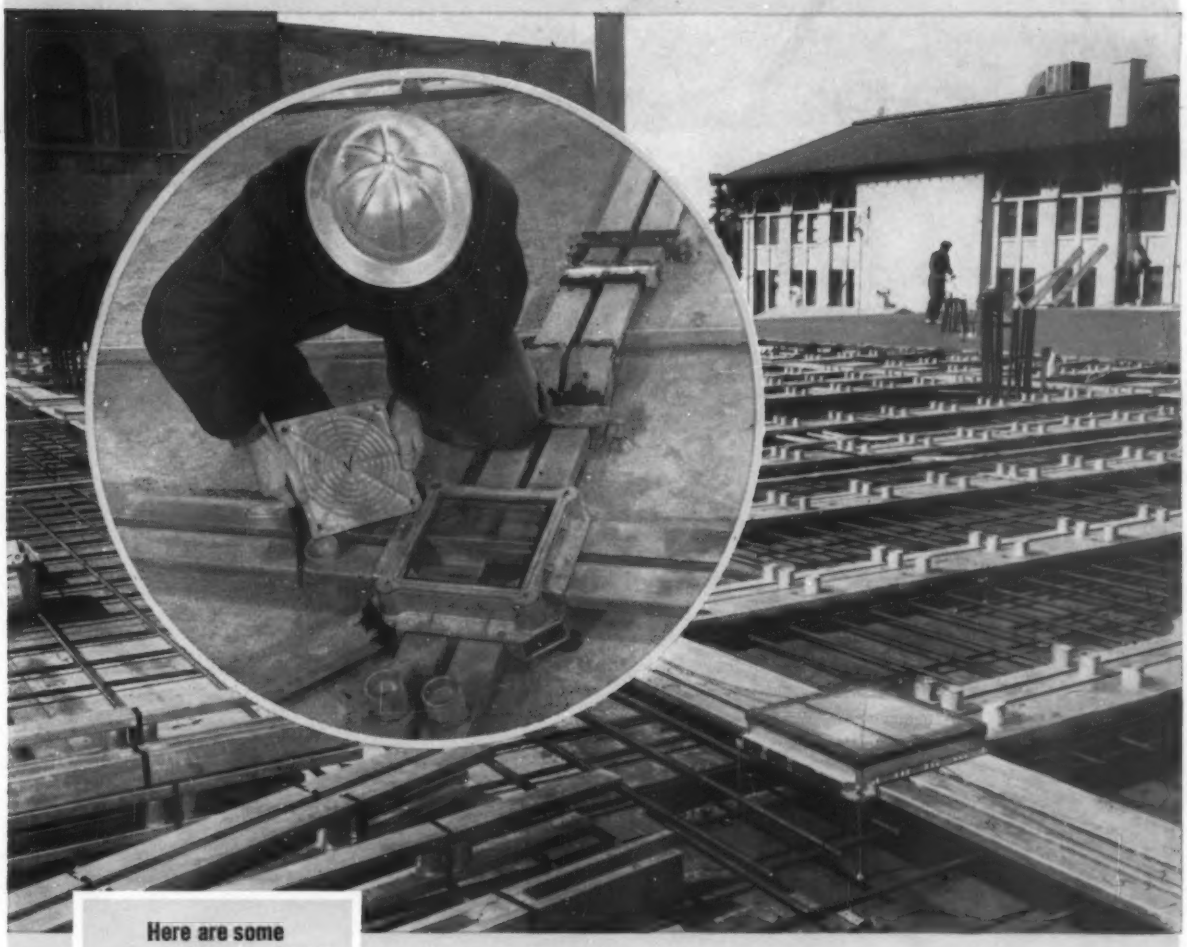

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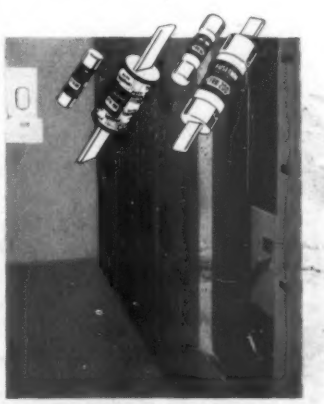

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